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DRAINAGE OF AGRICULTURAL LAND
AN ANNOTATED BIBLIOGRAPHY
of selected references
1956-1964

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PREFACE

Many publications have been written throughout the world on drainage research and its applications. Since 1955, materials such as plastics have opened up new fields of drainage and seepage control; machinery has been developed for all types of drainage materials; new methods have been used to speed up drainage; improved practices have been developed for irrigation and salinity control; and better maintenance has helped solve some of the problems of drainage in the field. Moreover, research in related areas such as soil physics, hydrology, and hydraulics has created new instruments and techniques which have improved drainage procedures.

To keep up with the demand for information on both surface and subsurface drainage, this annotated bibliography has been compiled. It brings up-to-date "Drainage of Agricultural Land, a Bibliography of Selected References",by E. G. Davis and M. L. Gould, published in May 1956 as U. S. Department of Agriculture, Miscellaneous Publication no. 713. Hopefully, it will prove useful as a ready reference to all those interested in drainage and its many aspects such as history, economics, needs, designs, applications, use, and problems.

Arrangement is alphabetical under broad subject classification. Call numbers following citations are those used in the National Agricultural Library.

This bibliography was compiled by the Agricultural Research Service, Soil and Water Conservation Research Division, and published by the National Agricultural Library as part of the Library's continuing efforts to keep research personnel informed of the latest literature in all areas of agricultural research.

John Sherrod

John Sherrod
Director
National Agricultural Library

SOURCES CONSULTED

Bibliography of Agriculture, 1956-65

Abstracts of Recent Published Material on
Soil and Water Conservation, 1956-65

Publication list of the Soil and Water Conservation
Research Division, Agricultural Research Service

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CONTENTS

		Page Number	Index Number
I.	GENERAL		

		Page Number	Index Number
A.	Laws, Economics, History, Statistics, Districts, and Organizations	1	1-155
B.	Drainage needs, Drainage problems, Drainage programs, and Books and Bibliographies on more than one phase of drainage	14	156-364

II. RESEARCH IN RELATED TECHNICAL FIELDS THAT CONCERNS DRAINAGE

		Page Number	Index Number
A.	Soil Science (Soil Physics, Soil Chemistry, Soil Genesis and Classification and Soil Biology.)	26	365-1188
B.	Hydrology and Geology	114	1189-1499
C.	Soil Mechanics and Hydraulics	151	1500-1596

III. RESEARCH IN DRAINAGE REQUIREMENTS AND EFFECTS

		Page Number	Index Number
A.	Design of drainage systems	162	1597-2420
B.	Effect of drainage and/or salinity on Crops, Soils, Trees, Diseases, Microbiology, and Fertilizer use	242	2421-2993

IV. DRAINAGE PRACTICES - RESEARCH AND APPLICATION

		Page Number	Index Number
A.	Surface drainage	302	2994-3272
B.	Subsurface drainage	325	3273-3501
C.	Pump Drainage and wells	343	3502-3580
D.	Drainage of Irrigated Lands and Drainage for Salinity Control	351	3581-4086
E.	Equipment and materials	393	4087-4468
F.	Maintenance (Includes dikes, weed control, seepage control, and maintenance prevention of drainage systems.)	420	4469-4821

V. SPECIAL PROBLEMS

		Page Number	Index Number
A.	Organic soil drainage	452	4822-4947
B.	Forest drainage	461	4948-5024
C.	Interception drainage	467	5025-5036
D.	Mosquitoes and Wildlife	468	5037-5092
VI.	SYSTEM DEVELOPMENT	474	5093-5186

VII. INDEX

		Page Number	Index Number
A.	Author	481	
B.	Subject Matter	507	

DRAINAGE OF AGRICULTURAL LAND AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES, 1956-1964

Compiled by Charles B. Crook
Soil and Water Conservation Research Division
Agricultural Research Service

GENERAL

Laws, Economics, History, Statistics, Districts, and Organizations

1. Abramowicz, M. WATER COOPERATIVES OF SIEDLCE COUNTY. (Pol) Wiad. Melior. i Lakarskie. 5(6): 185-186. Nov./Dec. 1962. 54.8 W63

2. Bennett, N. B., Jr. COST ALLOCATION FOR MULTIPLE-PURPOSE WATER PROJECTS. Amer. Soc. Civil Engin. Trans. 123: 85-92. 1958. 290.9 Am3

The separable costs-remaining benefits method of cost allocation has not been used long enough to understand precisely its procedural details and basic concepts. The dependence of this method on benefits and alternate costs was emphasized, together with the meanings attached to single-purpose alternate costs, specific and separable costs, joint costs, and remaining project costs. These concepts were examined in relation to each other and to the broad principles of cost allocation, use of project works, project formulation, and legislative history.

With discussion by Messrs. Frederick L. Hotes, Eugene W. Weber, Wendell E. Johnson, Charles A. Cocks, and Newcomb B. Bennett, Jr. pp. 93-100.

3. Berglund, G. DISTRIBUTION OF COST IN A DRAINAGE ASSOCIATION. (Sw) Grundforbattring 17(3): 217-220. 1964. 54.8 G92

4. Bontempo, S. A. WHOSE JOB IS DRAINAGE CONTROL? N.J. Dept. Health, Pub. Health News 41(12): 428-429. Dec. 1960. 449.7 N46P

A report was given on the need of drainage work by county and state governments in New Jersey to control mosquitoes and to give drainage facilities for the entire area.

5. Borton, M. E., and Ellis, H. H. SOME LEGAL ASPECTS OF WATER USE IN LOUISIANA. La. Agr. Expt. Sta. B. 537, 114 pp. 1960. 100 L93

A report was given on the legal aspects of water use in Louisiana, particularly as they apply to agriculture.

6. Bribiesca-Castrejon, J. L. HISTORY OF THE HYDROLOGY OF THE VALLEY OF MEXICO. (Sp) Ingen. Hidraul. en Mex. 14(3): 43-61. maps. July/Sept. 1960. 290.8 In43
English summary.

A report was given on the history of drainage and early drainage projects in Mexico.

7. Brighten, C. W. IN COURSE OF PRACTICE. XIII. SOME NOTES ON VICTORIAN LAND DRAINAGE SCHEMES. Chartered Land Agents' Soc. J. 59(4): 158-160. Apr. 1960. 282.9 L22

A report was given on some of the Victorian land drainage schemes in England.

8. Bullard, R. G. THE NEW WATER RIGHTS LAW IN IOWA. U.S. Mo. Basin Inter-Agency Comt. Minutes Mtg. 98 (app. D), 6 pp. 1958. 173 M69

A report was given on the new water rights law in Iowa.

9. Calzecchi-Onesti, A. ORIENTATION FIGURES ON DRAINAGE. (It) Gior. di Agr. 66: 237-238. June 24, 1956. 16 It1G

10. Chiusoli, G. RIVERS, TORRENTS, AND RECLAMATION SOCIETIES. (It) Rass. dell'Agr. Ital. 17(4): 28. Apr. 1962. 281.8 R18

11. Cholakov, S. IRRIGATION AND DRAINAGE SYSTEMS AS FACTORS IN REGIONAL ADMINISTRATION OF BULGARIAN AGRICULTURE. U.S. Joint P. Res. Serv. Transl. East European Agr. Forestry and Food Indus. 117: 1-13. Feb. 1, 1963. 173 J663Ste
Translation from Izvestiya Na Vishiya Institut Za Narodno Stopanstvo. 3: 34-46. July/Sept. 1962.

A report was given on the laws and administration of irrigation and drainage systems in Bulgaria.

12. Clark, R. E. NEW MEXICQ WATER LAW SINCE 1955. Nat. Resources J. 2(3): 484-561. Ref. Dec. 1962. 280.8 N19

A report was given on New Mexico's cases involving water law since 1955 concerning surface water and ground water.

13. Coleman, W. J. STATE-COUNTY-LOCAL COOPERATION UNDER DELAWARE DRAINAGE LAWS. U.S. Dept. Agr., Agr. Res. Serv. ARS 43-98, 40 pp. Dec. 1959. A281.9 R313A

A comparison and evaluation were made of various provisions of the existing drainage laws of Delaware to consider the States' experience in creating, financing, and managing certain selected drainage organizations to see if the Delaware tax ditch (a drainage organization) could act as a sponsor or cosponsor of a watershed project under the Watershed Protection and Flood Prevention Act.

14. Concalves, P. A. IN 1860 THEY WERE ALREADY DRAINING THE MARSHES. (Por) Lav. Arroz. 16(187): 9. Aug. 1962. 59.8 L39

15. Consolo, F. ORGANIZATIONAL REQUIREMENTS IN RECLAMATION DISTRICTS OF THE SOUTH. (It) Nuova Agr. Lucana 7(9): 134-137. (Cont.) Sept. 1959. 16 N923

16. Cornell, J. H. WATER USE LEGISLATION, THEORY, AND PRACTICE. Wildlife N.C. 20(6): 14-16. June 1956. 279.8 N812

A discussion was given of theory and practice of water use legislation in North Carolina.

17. Cotner, M. L., and Schmid, A. A. DRAIN LAW FOR MICHIGAN LANDOWNERS. Mich. State U. Ext., Ext. B. E-382, 16 pp. Sept. 1963. 275.29 M58B

A summary was given of the most relevant parts of the Michigan Drain Code and the applicable common law of drainage.

18. Czychowski, M. THE HANDLING OF DRAINAGE METHODS IN CONSOLIDATION OF HOLDINGS FROM A WATER RIGHTS STANDPOINT. (Ge) Recht der Landwirt. 14(11): 279-281. Nov. 1962. 30.58 R24

19. Darpoux, R. ESSAY ON THE ECONOMIC INTEREST OF THE DRAINAGE OF "MARAIS" IN LIMAGNE. (Fr) Min. de l'Agr. B. Tech. d'Inform. 159: 411-424. map. Ref. May 1961. 14 F844B

20. Dobkins, B. B. E. THE SPANISH ELEMENT IN TEXAS WATER LAW. Diss. Abs. 18(5): 1776-1777. May 1958. 241.8 M58

A report was given on the effect of the Spanish element in Water Laws in Texas.

21. Drablos, C. J. W. AGRICULTURAL AND HIGHWAY DRAINAGE LAWS. Ill. Res. 5(3): 12-13. Summer 1963. 100 IL64

A discussion was given of agricultural and highway laws in Illinois.

22. Drablos, C. J. W., and Jones, B. A. ILLINOIS HIGHWAY AND AGRICULTURAL DRAINAGE LAWS. Ill. U. Engin. Expt. Sta. C. 76, 73 pp. Ref. 1963. 290.9 IL62

Existing Illinois laws relating to highway and agricultural drainage were compiled and analyzed.

23. East, L. R. THE INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE. Chamber Agr. Victoria Ybk. 1962: 11, 13, 15, 17-18. 1962. 23 V663

A report was given on the accomplishments of the International Commission on Irrigation and Drainage in spreading world knowledge of the use of water resources.

24. Eichberger, W. G. LAND DRAINAGE IN THE MISSISSIPPI DELTA. J. Soil and Water Conserv. 16(2): 65-68. map. Mar./Apr. 1961. 56.8 J822

A report was given on the past, present, and outlook for the future for drainage in the Mississippi Delta area.

25. Ellis, H. H. SOME LEGAL ASPECTS OF WATER USE IN NORTH CAROLINA. In Conservation Foundation. THE LAW OF WATER ALLOCATION IN THE EASTERN UNITED STATES. pp. 189-376. Ronald., N.Y. 1958. 292 C768

A discussion of water laws in North Carolina was given that included drainage.

26. Ellis, H. H. WATER LAW IN THE EASTERN UNITED STATES AS RELATED TO WATER RESOURCES DEVELOPMENT. Soil Conserv. Soc. Amer. Proc. Annu. Mtg. 17: 155-174. Ref. 1962. 56.9 So33P

A discussion was given on water law in the Eastern United States as related to water resources development.

27. Ellis, H. H. WATER LAW IN EASTERN UNITED STATES. J. Soil and Water Conserv. 18: 19-27. 1963. 56.8 J822

Competition for natural resources has caused man to devise various systems for their allocation to individuals and groups. Even in the relatively humid eastern part of the United States, expanding needs for water resulted in an elaborate system of water rights and law. The general nature of water laws in relation to water resources development in the 31 Eastern States was described.

28. Ellis, H. H., and Bausman, R. O. SOME LEGAL ASPECTS OF WATER USE IN DELAWARE. U. Del. Agr. Expt. Sta. B. 314, 37 pp. 1955. 100 D37S

Use of Delaware's water resources by industries, municipalities, farm irrigators, and others has increased rapidly and some water users are beginning to experience seasonal or periodic water shortages. These shortages are increasing the possibility of disputes between water users regarding their legal rights to use water from various sources for certain purposes or on certain lands. Some of the Delaware laws relating to such questions, as well as some of the legal doctrines and statutes that have been developed in other Eastern and Western States were described.

29. Farmer, E. J. WATER AND LAW. Colo. Agr. Expt. Sta. B. 505S, 25 pp. 1960. 100 C71S

On May 1, 1957, the Colorado Legislature enacted a ground water law which provides control over " . . . any water not visible on the surface of the ground under natural conditions."

The law provides that within three years from the effective date of the act all ground water users must register existing wells with the state engineer. New wells cannot be drilled or the supply of water from existing wells increased unless the user applies to the state engineer for a "Permit to Use Ground-Water." The state engineer will issue the permit unless it comes from within a "Tentatively Critical Ground-Water District."

30. Feng, S. W. THE EVOLUTION OF THE DRAINAGE SYSTEM OF THE MINCHIN OASIS. (Ch) Acta Geog. Sinica. 29(3): 240-249. map. Sept. 1963. 331.8 T45
English summary.

A history was given on the evolution of the drainage system of the Minchin oasis in China.

31. Flodkvist, H. CONTRIBUTIONS OF THE AGRICULTURAL SOCIETIES TO SOIL IMPROVEMENT. (Sw) Hushsallsk. Tidskr. 26(4): 83, 85. 1959. 11 H9522

32. Fredborg, A. REGULATION AND DRAINAGE OF SKERNA DELTA. (Da) Dansk Hedeselsk. Hedeselsk. Tidsskr. 77: 33-40. Feb. 15, 1956. 11 H35

33. Fussell, G. E. DIGGING THE OLD FEN DRAINS. Land Agents' Soc. J. 57(7): 287-291. July 1958. 282.9 L22

A report on major drainage operations in the 17th century was given.

34. Galan, C. De. THE ECONOMIC DEVELOPMENT OF ZEELAND. (Du) Nederland. Heidemaatsch. Tijdschr. 73(12): 362-366. map. Dec. 1962. 12 N282

35. Goncalves, P. A. A LAW OF EMPIRE DAYS AND THE OLD WATER LAWS. (Por) Lav. Arroz. 17(197): 15, 40. Aug. 1963. 59.8 L39

36. Goodland, N. DRAINAGE THROUGH HISTORY. Farm 14(5): 24-26. Sept./Oct. 1964. 58.8 F2225

A report was given on a history of drainage and drainage equipment.

37. Gordin, I. M. ORGANIZATION AND OPERATION OF AMELIORATION-CONSTRUCTION PROJECTS. (Rus) Moskva, izd-vo selkhoz lit-ry, zhurnalov i plakatov. 103, 327 pp. 1963. 290 G65

38. Graham, L. O. CONFERENCE ON LEGAL PROBLEMS IN WATER RESOURCES. U. Calif. Comt. Res. Water Resources. 262 pp. 1957. 292 C769

A report was given on papers presented at the Conference on legal problems in water resources that was held in Berkeley, Calif., May 15-17, 1957.

39. Grimes, J. W. STATE OF SOUTH DAKOTA WATER LAWS. Mo. Basin Inter-Agency Comt. Minutes Mtg. 82: C1-C3. 1955. 173 M69
Discussion, pp. 7-8.

A report was given on the revised water laws covering both ground and surface waters in South Dakota.

40. Guzman, L. E. THE AGRICULTURAL TERRACES OF THE ANCIENT HIGHLAND MAYA. (Abs.) Assoc. Amer. Geog. Ann. 48(3): 266. Sept. 1958. 500 As73

A history was given on the terraces of Maya in Mexico.

41. Hakansson, A. COST OF DRAINAGE. (Sw) Forsok och Forsk. 13: 105-107. Oct. 1956. 11 F77

42. Hannah, H. W. ILLINOIS FARM DRAINAGE LAW. Ill. U. Agr. Ext. C. 751, 35 pp. Jan. 1956. 275.29 IL62C

A report was given on Illinois farm drainage laws.

43. Harber, D., and Bergen, S. W. eds. THE LAW OF WATER ALLOCATION IN THE EASTERN UNITED STATES. The Ronald Press. 643 pp. 1958. 292 C768

The papers and proceedings were given of a symposium held in Washington, D.C., Oct. 1956, on the law of water allocation in the Eastern United States.

44. Harding, S. T. STATUTORY CONTROL OF GROUND WATER IN THE WESTERN UNITED STATES. Amer. Soc. Civil Engin. Trans. 120: 490-498. 1955. 290.9 Am3

The increasing importance of the use of ground water in the western states of the United States together with the overdraft that occurs in many areas makes it essential that methods be found to enable individual users to secure an equitable share of the available supply and to limit draft to the safe yield in order that the use of ground water may be permanent and stable. The delay in the accomplishment of these results has been caused as much by lack of agreement on what should be done as it has by the search for legal means for this accomplishment. Conditions in some areas are such that the need for control outweighs the difficulties of its enforcement.

45. Harvey, N. RELICS OF A GREAT ACHIEVEMENT; SOME VETERAN DEEP-DRAINAGE SCHEMES. Land Agents' Soc. J. 54: 475-477. Oct. 1955. 282.9 L22

A report was given on the condition of some early stone drains and tile drain systems in Great Britian. Most of the stone drains were laid before the middle of the 19th century and a lot of the tile drains were laid between 1845 and 1880. Many of the systems are still in good condition but others need cleaning and improvement.

46. Harvey, N. LOW ON LAND DRAINAGE. Land Agents' Soc. J. 57(2): 71-74. Feb. 1958. 282.9 L22

A report was given on a chapter on land drainage by David Low in his book "On Landed Property" published in 1844. He reported on the use of brush drains, stone drains, tile drains, slate drains, wood drains, mole drains, and subsoiling.

47. Hedges, R. F., and Garner, M. M. STATUS OF STATE LEGISLATION RELATING TO THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT, AS AMENDED. U.S. Dept. Agr., Soil Conserv. Serv. SCS-TP-142, 28 pp. 1963. 1.96 Ad6Tp

The Watershed Protection and Flood Prevention Act of 1954, as amended, established a new national policy for Federal assistance to State and local agencies in projects for flood prevention and the conservation, development, utilization, and disposal of water. By 1963, 43 States had enacted laws to enable State and local agencies to cooperate with the Secretary of Agriculture in activities authorized by the Act. Summaries of certain provisions of the State laws and some of the reasons for their enactment were given.

48. Hellinga, F. LOCAL ADMINISTRATION OF WATER CONTROL IN A NUMBER OF EUROPEAN COUNTRIES. Internatl. Inst. Land Reclam. and Impr. P. 8, 55 pp. 1960. 54.9 In8

A report was given on local administration of water control in a number of European countries.

49. Henning, H. RECKONING OF THE ECONOMICS AND EFFECTS OF AGRICULTURAL RECLAMATION. (Ge) Deut. Landwirt. 13(1): 38-42. Ref. Jan. 1962. 18 D4822

50. Herlong, B. E. FLORIDA WATER LAWS. Citrus Indus. 44(9): 17-18, 24. Sept. 1963. 80 C49

A report was given on water laws in Florida.

51. Hermansen, N. K. ECONOMY OF DRAINAGE. (Da) Dansk Skovfor. Tidsskr. 41: 131-134. Mar. 1956. 99.8 D23

52. Higginson, R. K. OWNERSHIP OF WATER RIGHTS AND RESPONSIBILITY FOR WATER USE. Utah Mosquito Abatement Assoc. Proc. Annu. Mtg. 17: 17-18. 1964. 420 Utl

A report was given on the responsibility of water use by those owning water rights in Utah.

53. Hoelscher, L. IMPROVEMENTS IN FENCING AND DRAINAGE IN MID-19TH CENTURY ENGLAND. Agr. Hist. 37(2): 75-79. Ref. Apr. 1963. 30.98 Ag8

A history was given on the improvement of drainage since hedgerows were removed after fencing was improved in England.

54. Hutchins, W. A. A COMPARISON OF RIPARIAN AND APPROPRIATIVE RIGHTS. Mtg. Southwestern Soc. Sci. Assoc., Dallas, Tex. Apr. 8-9, 1955.

Riparian and appropriative rights are rights to the use of water. They are accorded by different systems of water law known, respectively, as the riparian doctrine and the appropriation doctrine. In some States both doctrines are recognized concurrently with respect to the water of watercourses; in other States, only the riparian doctrine is recognized; and in still others, the appropriation doctrine only. The United States Supreme Court has taken the position that each State is free to accept or to reject either system of water law.

Appropriative rights in some States may attach to percolating ground waters. In some, rights analogous to riparian rights exist in lands that overlie percolating waters. This discussion, however, is confined to riparian and appropriative rights in watercourses. A watercourse, in the eyes of the law, comprises a definite natural stream flowing in a definite natural channel and originating from a definite source or sources of supply.

55. Hutchins, W. A. THE NEW MEXICO LAW OF WATER RIGHTS. Tech. Rpt. 4: 1-61. 1955.

This statement of the New Mexico law of water rights was prepared as part of the revision of "Selected Problems in the Law of Water Rights in the West," which was issued in 1942 as Miscellaneous Publication 418 of the United States Department of Agriculture.

56. Hutchins, W. A. THE DEVELOPMENT AND PRESENT STATUS OF WATER RIGHTS AND WATER POLICY IN THE UNITED STATES. J. Farm Econ. 37: 866-874. Dec. 1955. 280.8 J822

A report was given on the development and present status of water rights and water policy in the United States.

57. Hutchins, W. A. IRRIGATION WATER RIGHTS. Western Water News Sup. Jan. 1956.

Irrigation water rights in the Western States relate chiefly to surface watercourses—often referred to as streams—and to percolating ground waters. In legal parlance, percolating waters are distinguished from waters flowing in definite underground streams. In California, percolating waters include waters in artesian basins.

This discussion was confined chiefly to rights in surface streams and in percolating waters. Furthermore, the emphasis was upon California water rights.

58. Hutchins, W. A. IRRIGATION WATER RIGHTS IN CALIFORNIA. Calif. Agr. Expt. Sta. Ext. Serv. C. 452, 55 pp. 1956. 100 C12S

California farmers who use irrigation water—or plan to use it—need to know something about water rights. The subject is not a simple one; for there are several kinds of water rights in this state, and each is subject to a somewhat different set of laws. This circular explains, in layman's language, the principles set forth in these laws and in laws on water wells and dams.

59. Hutchins, W. A. THE MONTANA LAW OF WATER RIGHTS. Mont. Agr. Expt. Sta. B. 545, 121 pp. Aug. 1958. 100 M76

A report was given on Montana law on water rights.

60. Hutchins, W. A., Smrha, R. V., and Smith, R. L. THE KANSAS LAW OF WATER RIGHTS. Div. of Water Resources, Kans. State Bd. Agr., and Kans. State Water Resources Bd., Topeka, Kans. 1957.

This statement of the Kansas law of water rights was prepared as part of the revision of "Selected Problems in the Law of Water Rights in the West."

61. Iakovlev, B. I. CONTRIBUTION TO THE HISTORY OF ONE OF THE OLDEST DRAINAGE SYSTEMS IN RUSSIA. (Rus) Gidrotekh. i Melior. 1960(4): 51-54. map. Apr. 1960. 290.8 G362

62. Iandolo, E. THE COURT OF ACCOUNTS AND RECLAMATION ASSOCIATIONS. (It) Bonifica Integrale 12(1/2): 19-21. Jan./Feb. 1958. 55.9 As72

63. Irwin, R. W. DRAINAGE LAW. Ontario Dept. Agr. P. Rev. 240, 6 pp. Oct. 1963. 7 On8P

A revised edition of Drainage Law was given for Ontario, Canada.

64. Jacobsen, T., and Adams, R. M. SALT AND SILT IN ANCIENT MESOPOTAMIAN AGRICULTURE. Sci. 128(3334): 1251-1258. Nov. 21, 1958. 470 Sci2

A report was given on the progressive changes in the soil salinity and sedimentation that contributed to the breakings of past civilizations in the country now called Iraq.

65. Jacobson, P. WATER CONSERVATION MEASURES. II. MECHANICAL PRACTICES. In Timmons, J. F., ed. IOWA'S WATER RESOURCES. pp. 40-44. Ames, Iowa State Col. Press. 1956. 292 T48

The major engineering land treatment measures which affect runoff are contouring, terraces, diversions, waterways, ponds, drainage, and detention type structures.

The estimate of the practices needed and the accomplishments to date by farmers assisted by the Soil Conservation Service and the Agricultural Program Service were given.

66. Japan Agriculture Land Bureau. Resource Section. SURVEY REPORT ON PRESENT CONDITION OF AGRICULTURAL IRRIGATION AND DRAINAGE IN JAPAN. (Ja) Tokyo. 1954. 55 J272

A survey was given of the present condition of agricultural irrigation and drainage in Japan.

67. Johnson, J. A. WATER-USE AND WATER-RIGHTS POLICY IS CHANGING. J. Soil and Water Conserv. 14: 3-6. 1959. 56.8 J822

Much has been said and written about water resources and the importance of their full development and utilization in the face of expanding human needs. The public is more aware of problems of water use, excess water, damage to water quality, and growing needs for greater quantities of good quality water in an expanding economy. People generally have some understanding of what is being done to solve these problems through conservation and protection programs. State legislatures and water-user organizations are assuming greater responsibilities for education on water facts, but many of us have little opportunity to develop an understanding of what is being accomplished state by state in approaching these problems through water policy legislation.

In some southeastern states, water policies have been formally declared for the first time and water laws and programs have been adjusted in an effort to meet modern needs.

Studies are being continued in most cases. The people and their legislatures recognize that further adjustments will be necessary, if legal institutions and users are to keep abreast of changing conditions.

68. Joint Committee on Water Problems. California Legislature. DRAINAGE PROBLEMS OF THE SAN JOAQUIN VALLEY OF CALIFORNIA. 10th Partial Rpt. Senate Calif. Legislature. 78 pp. Mar. 1957. (Dept. Int. HD, 1694, C2A 32, 1957.)

The results were given of a legislative investigation and study of the lack of proper drainage facilities in the San Joaquin Valley of California.

69. Jones, D. S. NEBRASKA WATER LEGISLATION AND ASSOCIATED ADMINISTRATIVE PROBLEMS. Amer. Water Works Assoc. J. 48: 993-998. Aug. 1956. 292.9 Am32J

A report was given on the water rights laws in Nebraska and administrative problems associated in enforcing these laws.

70. Jones, D. S. DESIRABLE FEATURES OF WATER RIGHTS LAW. J. Irrig. and Drain. Div., ASCE 89(IR 4): 1-6. Dec. 1963. 290.9 Am3Ps

Experience in administrating state water laws has shown that laws that are based on the appropriation doctrine and that do not recognize any claimed riparian rights are more desirable from the viewpoint of an administrator. The law should declare that all waters of the state are public and are subject to appropriation and use as provided by law. One central state agency should have authority to grant water rights, to police the streams, to enforce said rights, and to cancel rights when the appropriator ceases to use water for the purpose for which the appropriation was granted. The decisions of the administrator should be appealable directly to the Supreme Court. Preferential uses of water should be spelled out in the law, and the use of water for a purpose with a high preference should be permitted if a prior appropriator for an inferior purpose is justly compensated for any interference resulting therefrom. A water rights law should apply equally to all of those who desire to use the public waters, including agencies of the United States.

71. Juusela, T. DISTRIBUTION OF COSTS IN JOINT DRAINAGE PROJECTS IN FINLAND. Acta Agr. Scandinavia. 14(1): 21-32. 1964. 11 Ac82

A report was given on the distribution of costs in joint drainage projects in Finland.

72. Kaiser, G. WATER LAW AND CONSOLIDATION OF HOLDINGS IN BAVARIA. (Ge) Recht Landwirt. 16(7): 172-177. July 1964. 30.58 R24

73. Kargol, M., and Fedorowicz, W. SOCIAL AND ECONOMIC EFFECTS OF AGRICULTURAL IMPROVEMENTS IN WARSAW PROVINCE. (Pol) Nowe Roin. 12(6): 4346. Mar. 16/31, 1963. 20.5 N86.

74. Klein, F., and Leidel, H. WATER COOPERATIVES AND WATER COOPERATIVE RIGHTS. (Ge) Z. f. das Gesam. Genossenschw. 10(1): 1-20. First Q. 1960. 286.8 Z3
English summary.

A report was given on associations for irrigation, drainage, and soil management in Germany and the laws that affect these associations.

75. Kruijff, G. De. IS "COOPERATION" IN WATER DISTRICTS SOMETHING PECULIAR TO OUR TIME? (Du) Nederland. Heidemaatsch. Tijdschr. 73(1): 4-13. maps. Jan. 1962. 12 N282

76. Kuratorium Fur Kulturbauwesen. ANNUAL MEETING ON OCTOBER 5, 1960 IN LINDAU-BODENSEE. (Ge) Hannover. 1960. 76 pp. 1960. 290.9 K96

77. Kuratorium Fur Kulturbauwesen. ANNUAL MEETING, OCTOBER 3/4, 1962 IN WETZLAR. (Ge) Hannover, 86 pp. 1962. 290.9 K96

78. Kurkus, Y. ON DRAINING AGRICULTURAL PLOTS AND DRAINAGE COSTS. (Es) Sotsialist. Pollum. 17(9): 402-403. May 1962. 20 So74

79. Landt, E. ADDITIONAL OBJECTIONS TO THE ESTABLISHMENT OF WATER AND SOIL ASSOCIATIONS. (Ge) Recht der Landwirt. 15(9): 231-233. Sept. 1963. 30.58 R24

80. Landt, E. WATER PROTECTION DISTRICTS AND THEIR ACCOMPLISHMENTS. (Ge) Recht der Landwirt. 16(6): 147-148. June 1964. 30.58 R24

81. Lara-Nieto, J. DE. ECONOMICS AND FINANCING OF IRRIGATION AND DRAINAGE WORKS IN SPAIN—SUBVENTION BY THE GOVERNMENT. Cong. Irrig. and Drain. Trans. 5(3): R.15.317-R.15.322. 1963. 55.9 C7652

A report was given on the economics and financing of irrigation and drainage works in Spain. The subvention of these projects by the government was discussed.

82. Larson, C. L. COOPERATION SOLVES KNOTTY DRAINAGE PROBLEMS. Minn. Farm and Home Sci. 14(1): 4, 8. Oct. 1956. 100 M668

A report was given on the use of drainage districts in Minnesota to help solve drainage problems where it represents more than one farm.

83. Lochen, A. WATER POLICY IN U.S.A. AND NORWAY. (No) Norske Myrselsk. Meddel. 54(6): 155-165. Ref. Dec. 1956. 11 N813

84. Lohr, G. RELATION BETWEEN EXPENDITURE AND RETURNS IN LAND IMPROVEMENT. (Ge) Wasser u. Boden. 11(10): 344-347. Oct. 1959. 56.8 W28

85. Loiter, M. N. METHODOLOGY OF DETERMINATION OF ECONOMIC EFFECTIVENESS OF CAPITAL INVESTMENTS AND OF NEW EQUIPMENT IN LAND IMPROVEMENT. (Rus) In Akademiya Sel'skokhozyaistvennykh Nauk Imeni V. I. Lenina. Otdelenie Ekonomiki i Organizatsii Sel'skokhozyaistvennogo Priozvodstva. EKONOMICHESKAYA EFFEKTIVNOST' KAPITAL'NYKH VLOZHENII V SEL'SKOE KHOZYAISTVO. pp. 192-218. 1962. 284 Ak12

86. Macnair, A. S. EARLY RECLAMATION IN THE LOWLAND PEAT MOSSES. Scot. Forestry 18(3): 218-222. July 1964. 99.8 Sco3

A history was given on the early reclamation of lowland peat mosses in Scotland.

87. Maijala, K. ON THE POSSIBILITIES OF SPEEDING UP THE WORK FOR THE IMPROVEMENT OF THE MAIN DRAINAGE DITCHES ON FARMS. (Fi) Teho. 3: 98-100, 126. 1963. 20 T98
English summary, pp. 90.

A report was given on the use of subsidies to speed up the needed drainage ditches on farms in Finland.

88. Maloney, F. M. LEGAL ASPECTS OF FLORIDA WATER RESOURCES. Soil and Crop Sci. Soc. Fla. Proc. 16: 32-50. 1956. 56.9 So32

A report was given on present water laws in Florida.

89. Mann, D. E. THE POLITICS OF WATER IN ARIZONA. U. Ariz. Press. 317 pp. 1963. 292 M31

A discussion was given on the effect of politics on water laws in Arizona.

90. Mann, F. L., Ellis, H. H., and Krausz, N. G. P. WATER-USE LAW IN ILLINOIS. Ill. Agr. Expt. Sta. B. 703, 332 pp. map. Ref. 1964. 100 IL6S

A detailed report was given on water-use law in Illinois.

91. Manson, P. W. FARM DRAINAGE GOOD OR BAD? Hoard's Dairyman. 106(20): 985, 1107. Oct. 25, 1961. 44.8 H65

A discussion was given on the value of farm drainage practices.

92. Marin, S. SOME ASPECTS OF THE ECONOMY OF WATER AND LAND IMPROVEMENT IN THE PEOPLE'S REPUBLIC OF RUMANIA. (Fr) Cong. Irrig. and Drain. Trans. 5(3): R.15.617-R.15.621. 1963. 55.9 C7652

93. Maryland University Agricultural Extension Service. THE DRAINAGE LAW OF MARYLAND. Md. U. Ext. B. 196, 14 pp. Oct. 1962. 275.29 M36B

A report was given on the drainage laws of Maryland.

94. Menz, J. A. THE ECONOMIC EVALUATION OF A DRAINAGE PROJECT. J. Soil and Water Conserv. 19(1): 12-14. Jan./Feb. 1964. 56.8 J822

An evaluation procedure was given for making economic evaluation of drainage projects such as those under the Watershed Protection and Flood Prevention Act.

95. Merbitz, H. AVOID UNPROFITABLE DRAINAGE! (Ge) Mitt. der Deut. Landwirt.-Gesell. 77(45): 1478, 1480, 1482. Nov. 8, 1962. 18 N39

96. Milliman, J. W. PROBLEMS OF WATER DISTRICTS; ECONOMIC MERIT AND FEASIBILITY ARE IMPORTANT CONSIDERATIONS IN JUSTIFYING THE CONSTRUCTION OF PROPOSED DISTRICT PROJECTS. Calif. Agr. 12(1): 2, 16. Jan. 1958. 100 C12Cag

A report was given on the economic merit and feasibility requirements for justifying the construction of proposed district projects in California.

97. Molen, W. H. Van Der. THE DEVELOPMENT OF DRAINAGE RESEARCH. (Du) Landbk. Tijdschr. 73(15): 744-753. Ref. Sept. 1961. 105.2 Or3

98. Morton, P. W. FEDERAL-STATE RELATIONS IN THE FIELD OF WATER LAW. Natl. Reclam. Assoc. Proc. 28: 131-138. 1959. 55.9 N212

A discussion was given on Federal-State relations in the field of water law in the United States.

99. Mustoe, N. E. LAND DRAINAGE RATES. Chartered Land Agents' Soc. J. 62(2): 62-67. Feb. 1963. 282.9 L22

A report was given of land drainage rates in England.

100. Nichols, M. R. DRAINAGE PAYS IN WICOMICO DISTRICT [SALISBURY, MD.]. Soil Conserv. 21: 237-239. May 1956. 1.6 So3S

A report was given on the value of drainage in the Wicomico Soil Conservation Service District in Maryland. About 365 miles of new drainage ditches have been dug that have helped more than 18,000 acres of cropland. Surveys showed that 729 miles of additional ditches are needed to be dug or improved to benefit 33,000 additional acres of farmland.

101. Ohrstrom, A. OBSERVATIONS ON DRAINAGE AND LEASES. (Sw) Grundforbattring. 8: 258-270. 1955. 54.8 G92
English summary, pp. 286.

A report and discussion were given on a lecture on drainage and leases in Sweden.

102. O'Loan, J. LAND RECLAMATION DOWN THE YEARS. Ireland Dept. Agr. J. 55: 153-189. maps. Ref. Sept. 1959. 10 Ir2J

A history was given on land reclamation practices (mostly drainage) in Ireland.

103. O'Loan, J. ORIGIN AND DEVELOPMENT OF ARTERIAL DRAINAGE IN IRELAND AND THE PIONEERS. Ireland Dept. Agr. J. 59: 46-74. Ref. July 1963. 10 Ir2J

A report was given on the origin and development of arterial drainage in Ireland.

104. Otte, R. C., and Vlasin, R. D. DISTRICTS THAT MANAGE RESOURCES. U.S. Dept. Agr. Ybk. Agr. 1963: 429-438. Ref. 1963. 1 Ag84Y

A discussion was given on the districts that manage resources in the United States. Drainage, flood control, irrigation, and soil conservation districts were included in the discussion.

105. Peltola, J. SEASON OF DRAINING IS AT ITS BEST. (Fi) Teho. 5: 222-223. 1962. 20 T98
English summary, pp. 251.

A report was given on the financing by banks and subsidies of drainage work in Finland.

106. Petrescu, S. N. COMPUTATION OF THE ECONOMIC EFFICIENCY OF INVESTMENTS IN EMBANKMENTS, DRAINAGE AND IRRIGATION. (Fr) Cong. Irrig. and Drain. Trans. 5(3): R.15.359-R.15.390. 1963. 55.9 C7652
English summary.

The report outlines the principles, methods, and formula of calculation of the economic efficiency of the investments in levees, drainage, and irrigation works in Rumania.

107. Richason, B. F. THE NATURE, EXTENT, AND DRAINAGE OF THE WET LANDS OF NORTHERN INDIANA WITH SPECIAL REFERENCE TO CASS COUNTY. Diss. (Abs.) 21(6): 1519-1520. Dec. 1960. 241.8 M58

An abstract was given on the history, nature, extent, and drainage of the wet lands in northern Indiana.

108. Rosenberg, N. J. IRRIGATION EXTENSION AND LAND DRAINAGE IN ISRAEL. J. Soil and Water Conserv. 16(4): 182-183. July/Aug. 1961. 56.8 J822

A report was given on the research and extension work of the Field Service of the Water Authority and the Drainage Department of Water Planning for Israel, Ltd. for irrigation and land drainage in Israel.

109. Rusinov, I. F. DRAINAGE WORKS OF THE GENERAL I. I. ZHILINSKII. (Rus) Gidrotekh. i. Melior. 12: 51-52. Dec. 1964. 290.8 G362

110. Russell, E. J. LAND WON FROM THE SEA. I. THE PROBLEMS AND HOW THEY WERE MET. World Crops. 13(5): 179-182. May 1961. 281.8 W892

An illustrated report was given on the history of Zuiderzee project in the Netherlands.

111. Salliskopet For Agronomiski Hydroteknik. Batnadskommitten. EFFECT OF WATER REGULATIONS AND DRAINAGE ON THE VALUE OF FARM REAL ESTATE. (Sw) Grundforbattring. 14(2): 69-138. Ref. 1961. 54.8 G92

112. Samuel, G. G. RECLAMATION OF THE WIERINGERMEER POLDER. Gt. Brit. Min. Agr. Fisheries and Food Agr. 64(3): 125-129. June 1957. 10 G79J

The agricultural and social aspects of the reclamation of the first Zuiderzee polder, the Wieringermeer polder, were given. Since 1930, 50,000 acres have been reclaimed from ordinary sea water.

The main drainage canals and laterals were dredged while the land was still under the sea. Ordinary trenches, 2 feet deep, gave further drainage. As soon as soil conditions permitted, the open ditches were replaced by tile drains.

113. Savitskii, L. M. METHODOLOGY OF DETERMINATION OF ECONOMIC EFFECTIVENESS OF CAPITAL INVESTMENTS IN DRAINAGE AND AGRICULTURAL RECLAMATION OF DRAINED LAND. (Rus) In Akademiya Sel'skokhozyaistvennykh Nauk Imeni V. I. Lenina. Otdelenie Ekonomiki i Organizatsii Sel'-skokhozyaistvennogo Proizvodstva. EKONOMICHESKAYA EFFEKTIVNOST' KAPITAL'NYKH VLOZHENII V SEL'SKOE KHOZYAISTVO. pp. 226-231. 1962. 284 Ak12

114. Scheifele, M. CHIEF FORESTER AND CHAMBERLAIN FRIEDRICH HEINRICH GEORG FREIHERR DRAIS VON SAUERBRONN; A PIONEER OF FORESTRY IN BADEN. (Ge) Allg. Forst-u. Jagdztg. 129(10): 211-220. Ref. Oct. 1958. 99.8 AL3

115. Schmid, A. A. EVOLUTION OF MICHIGAN WATER LAWS: RESPONSE TO ECONOMIC DEVELOPMENT. Mich. Agr. Expt. Sta. C. B. 227, 34 pp. Mar. 1960. 100 M58S

A report was given on the evolution of water laws in Michigan in the response to economic development.

116. Schmid, A. A. MICHIGAN WATER USE AND DEVELOPMENT PROBLEMS. Mich. Agr. Expt. Sta. C. B. 230, 31 pp. 1961. 100 M58S

Michigan is a water wonderland with more than 36,000 miles of rivers and streams, 11,000 inland lakes, and 3,000 miles of Great Lakes shore line.

Michigan water use problems involve conflicts between irrigation and other uses such as recreation. It involves waste disposal conflicts, problems in establishing lake levels, and urban and industrial conflicts.

A discussion was given of some of the actual problems faced by Michigan people and what is being done to solve them both by informal agreements and by formal law. It includes consideration of the effects of water laws and whether they cover current problems.

117. Schulz, H. ONE HUNDRED YEARS OF DRAINAGE ADVICE; AN EXCURSION THROUGH THE HISTORY AND LITERATURE OF DRAINAGE. (Ge) Wasser u. Boden. 10(1): 12-14. Jan. 1958. 56.8 W28

118. Shih, Y-C. AMERICAN WATER RESOURCES ADMINISTRATION. I. and II. Bookman Assoc., Inc., N.Y. 1353 pp. 1956. 292 Sh6

These two volumes were devoted to water resources administration in the United States by Federal, State, and interstate agencies.

119. Simons, J. P. J. LIMBURG AGRICULTURE AND REGULATIONS FOR IMPROVEMENT OF THE AGRARIAN STRUCTURE. (Du) Nederland. Heidemaatsch. Tijdschr. 71(1): 22-27. (Cont.) Jan. 1960. 12 N282

120. Smith, R. L. THIS PROBLEM OF WATER RIGHTS. J. Irrig. and Drain. Div., ASCE 85(IR4): 41-63. Ref. Dec. 1959. 290.9 Am3Ps

A discussion was given of the problem on water rights in different sections of the United States.

121. Smith, S. C., and Castle, E. N. eds. ECONOMIC AND PUBLIC POLICY IN WATER RESOURCE DEVELOPMENT. Iowa State U. Press. 463 pp. 1964. 292 Sm4

A selection of twenty three papers were given that were written on economic and public policy in water resource development in the United States.

122. Smith-Hurd Illinois Annotated Statutes. THE DRAINAGE CODE: EFFECTIVE JANUARY 1, 1956. Burdette Smith Co., Chicago, Ill. 197 pp. 1955.

A new and modern drainage code was given along with an annotation of the Illinois drainage laws.

123. Solarski, H., and Grabarczyk, S. NATURAL AND ECONOMIC BACKGROUND OF AGRARIAN DRAINAGE SYSTEM IN THE PROVINCE OF OLSZTYN. (Pol) Olsztyn. Wyzsza Szkola Roln. Zeszyty Nauk. 11(112): 175-191. Ref. 1961. 20.5 OL8
English summary.

A history was given of some agrarian drainage systems in Olsztyn in Poland. Statistics were given on the drainage maintenance and installation of new drains since World War II and the amount needed in 1960.

124. Southeastern Water Law Conference, University of Georgia, 1961. WATER LAW AND POLICY IN THE SOUTHEAST; PAPERS PREPARED FOR PRESENTATION. Inst. Law and Govt. Sch. Law, U. Ga., Athens, Ga. 338 pp. 1962. 292.9 So84

The papers presented at the Southeastern Water Law Conference at the University of Georgia in 1961 were given.

125. Stanley, L. A. WATER RIGHTS. Oreg. State Hort. Soc. Annu. Rpt. 49: 4-11. 1957. 81 Or32

A report was given on water rights laws in Oregon.

126. Strong, D. C. SOME ECONOMIC AND LEGAL ASPECTS OF GROUND WATER DEVELOPMENT IN CACHE COUNTY, UTAH. Utah Agr. Expt. Sta. B. 435, 28 pp. map. May 1962. 100 Ut1

A report was given on the costs and returns of drainage for lowland areas in Utah. The extent to which ground water law and other institutional factors inhibited drainage was evaluated.

127. Sutton, J. G. DRAINAGE DEVELOPMENTS DURING THE PAST 50 YEARS. Agr. Engin. 38(6): 405-413. Ref. June 1957. 58.8 Ag83

A report was given on drainage developments in the United States during the past 50 years.

128. Tenny, M. K. WATER RIGHTS LAW IN IOWA. Amer. Water Works Assoc. J. 51(3): 329-332. Mar. 1959. 292.9 Am32J

A report was given on past and present water rights laws in Iowa.

129. Textor, H. WATER AND SOIL ASSOCIATIONS IN WEST GERMANY. (Ge) Wasser u. Boden. 3: 79-80. Mar. 1961. 56.8 W28

130. Thomas, H. E. HYDROLOGY VS. WATER ALLOCATION IN THE EASTERN UNITED STATES. In Conservation Foundation. THE LAW OF WATER ALLOCATION IN THE EASTERN UNITED STATES. pp. 164-187. Ronald., N.Y. 1958. 292 C768

A discussion was given of the conflict in the Eastern United States between hydrology—the science treating of water—and the systems or methods of allocation, water among users, as developed in statutes, court decisions, compacts, etc.

131. Thomas, R. O. LEGAL ASPECTS OF GROUND WATER UTILIZATION. J. Irrig. and Drain. Div. ASCE 85(IR4, 2283): 41-63. Dec. 1959. 290.9 Am3Ps

The historical basis of water rights doctrines were discussed. Some of the possible legal problem areas which may arise in planning and administering future ground water operations were presented.

132. Thomas, R. O. LEGAL ASPECTS OF GROUND WATER UTILIZATION. Amer. Soc. Civil Engin. Trans. 126(3): 633-654. 1961. 290.9 Am3

The historical basis of water rights doctrines; their application to rights to the use of ground water; general considerations affecting the regulation of rights; and various aspects of ground water utilization, including problems of recharge and water demand were presented. A presentation was made of some of the possible legal problem areas that may arise in planning and administering future ground water operations.

With Discussion by Messrs. Raphael G. Kazmann; Frederick L. Hotes; Paul Baumann; and Robert O. Thomas. pp. 654-661.

133. Thompson, D. GROUND WATER LEGISLATION. U.S. Mo. Basin Inter-Agency Comt. Minutes Mtg. 99(app. H), 4 pp. 1958. 173 M69

A report on ground water legislation in Nebraska was given.

134. Thomte, D., Olson, A., and Loftsgard, L. D. CHANGES IN NORTH DAKOTA'S WATER LAW. N. Dak. Farm Res. 22(12): 4-8. July/Aug. 1963. 100 N813B

A discussion was given on the changes in North Dakota's water law.

135. Timmons, J. F., O'Byrne, J. C., and Frevert, R. K. eds. IOWA WATER RESOURCES—SOURCES, USES, AND LAWS. Iowa State College Press. 223 pp. 1957. 292 T48

The papers presented at the seminar on Iowa's Water Resources—Sources, Uses, and Laws—were given. The six major divisions of the seminar paper are: (1) The sources and supplies of water; (2) the economics of water use and control; (3) the multiple demands of water; (4) water laws; (5) the functions of the government agencies regarding use and control of water; and (6) some possible solutions to Iowa's water problems.

136. Turney, J. R., and Ellis, H. H. STATE WATER-RIGHTS LAWS AND RELATED SUBJECTS. U.S. Dept. Agr., Econ. Res. Div. Misc. P. 921, 198 pp. 1962. 1 Ag84M

Publications dealing with water laws and related subjects in one region are of value to those concerned with such problems in other regions. Such publications include legal, economic, and related analyses. Special effort was made to achieve comprehensive coverage of publications dealing with State water-rights laws.

137. U.S. Bureau of the Census. U.S. CENSUS OF AGRICULTURE: 1959. FINAL REPORT—VOL. IV. DRAINAGE OF AGRICULTURAL LANDS. Washington, 1961. 364 pp. maps. 1961. 157.41 C3325

Statistics were given on drainage projects, size, type, area served, costs, and works for the United States.

138. U.S. Commission on Intergovernmental Relations. THE PROBLEM OF SPECIAL DISTRICTS IN AMERICAN GOVERNMENT. Washington (Its Report A-22). 112 pp. 1964. 173 In8272Pr

A commission report was given on the problems of special districts in American Government. Drainage, irrigation, and flood control districts were included in the discussion.

139. U.S. Farmers Home Administration. LOANS TO RURAL GROUPS: WATER SYSTEMS, SOIL CONSERVATION, DRAINAGE, SHIFTS IN LAND USE TO GRASSLAND, FORESTRY, RECREATION. U.S. Dept. Agr. PA-560, 6pp. folder. Apr. 1963. 1 Ag84Pro

A report was given on loans available to rural groups in the United States for drainage and other practices through the U.S. Farmers Home Administration.

140. Vanzetti, C. NEW WAYS OF DETERMINING THE PUBLIC ADVANTAGE OF RECLAMATION WORKS. (It) Agr. delle Venezie. 9: 403-411. Aug. 1955. 16 Ag826

141. Voigt, E. THE WORK OF MELIORATION COOPERATIVES IN THE POTSDAM DISTRICT. (Ge) Mitschurin Bewegung. 6(12): 532-534. June 15, 1957. 18 M695

142. Wallis, W. T. SOME ASPECTS OF THE EVOLUTION AND CURRENT APPLICATION OF WATER RESOURCES MANAGEMENT IN FLORIDA. Soil and Crop Sci. Fla. Proc. 16: 110-121. 1956. 56.9 So32

A history was given on the evolution of water resource management in Florida along with a report on the current application.

143. Wallis, W. T. THE DISTRICT'S HERITAGE FROM THE PAST AS A GUIDE TO ITS FUTURE DIRECTION. Soil and Crop Sci. Soc. Fla. Proc. 20: 192-196. 1960. 56.9 So32

A report was given on reclamation and flood control districts in Florida.

144. Wartena, L. A SURVEY OF WATER ADMINISTRATION PROBLEMS IN THE NETHERLANDS. (Du) Nederland. Heidemaatsch. Tijdschr. 66: 295-299. Dec. 1955. 12 N282

145. Weaver, M. M. EARLY HISTORY OF DRAIN TILE. Soil Conserv. 24(2): 46-47. Sept. 1958. 1.6 So3S

An illustrated report was given on the early history of drain tile. Stone, poles, brush, planks, and other material were used by early American farmers. The first known record for clay tile in the United States was 1835. All clay tiles in the U.S. were handmade until 1948. There were many shapes and variations in types of joints in the early tile.

146. Weaver, M. M. HISTORY OF TILE DRAINAGE. M. M. Weaver. Waterloo, N.Y. 343 pp. 1964.

A history was given of tile drainage in the United States prior to 1900.

147. Weaver, M. M., and Leiby, M. G. FARMING HISTORY IN OLD TILE. Soil Conserv. 27(11): 250-251. June 1962. 1.6 So3S

A history was given of tile drainage in the United States.

148. Wen, H. J., and Lin, C. L. THE DISTRIBUTION AND RECLAMATION OF SALINE-ALKALI SOILS OF NORTH CHINA PLAIN AND THE WEI-HO PLAIN IN THE PERIOD OF CHOU-HAN DYNASTIES. (Ch) Acta Pedol. Sinica. 12(1): 1-9. map. Ref. Mar. 1964. 56.9 Ac8
English summary.

A report was given on the reclamation of saline-alkali soils of North China from 1122 B.C. to 220 A.D. During that period, amelioration of these soils was accomplished by using good irrigation drainage systems, by leaching, by rice planting, and by silting from periodical flooding waters.

149. Wolman, A. ELEMENTS OF A STATE WATER PROGRAM. State Govt. 31(2): 23-26, 41. Feb. 1958. 280.8 St2

A series of elements were given that was considered essential for a State water program.

150. Wooten, H. H., and Jones, L. A. THE HISTORY OF OUR DRAINAGE ENTERPRISES. U.S. Dept. Agr. Ybk. Agr. 1955: 478-491. 1955. 1 Ag84Y

A history was given of drainage enterprises in the United States.

151. Wisman, O. WATER CONTROL IN WATER BOARD ASSOCIATIONS ON DRENTHE LANDS. (Du) Netherlands. Rlandbvoorlichtingsdienst. Landbvoorlichting. 15(10): 530-537. Oct. 1958. 12 N383M

152. Wright, G. A. DEE AND CLWYD RIVER BOARD. Roy. Welsh Agr. Soc. J. 24: 84-86. 1955. 10 R814

A report on the Dee and Clwyd River Board was given that included reports on land drainage, water conservation, and drainage districts in that area.

153. Yeutter, C. DIFFUSED SURFACE WATER LAW IN NEBRASKA. Nebr. U. Col. Agr., Dept. Agr. Econ. Rpt. 26, 23 pp. Ref. Feb. 1963. 281.9 N27

A report was given on diffused surface water law in Nebraska.

154. Zeeuw, J. W. De. HOW DID THEY DRAIN A HUNDRED YEARS AGO? (Du) Nederland. Heidemaatsch. Tijdschr. 71(1): 11-14. Jan. 1960. 12 N282

155. Zeeuw, J. W. De. HOW DID THEY DRAIN A HUNDRED YEARS AGO? (Du) Nederland. Heidemaatsch. Tijdschr. 71(2): 50-56. (Cont.) Feb. 1960. 12 N282

SEE ALSO--177, 199, 221, 244, 245, 252, 273, 282, 287, 292, 307, 321, 337, 338, 349, 350, 356, 541, 614, 785, 812, 853, 879, 892, 927, 1004, 1007, 1011, 1106, 1152, 1193, 1194, 1223, 1228, 1231, 1233, 1238, 1241, 1247, 1250, 1259, 1266, 1270, 1275, 1277, 1279, 1288, 1293, 1296, 1299, 1303, 1312, 1315, 1317, 1330, 1343, 1345, 1349, 1365, 1372, 1396, 1398, 1403, 1404, 1411, 1425, 1428, 1431, 1438, 1448, 1450, 1459, 1465, 1466, 1469, 1471, 1483, 1486, 1490, 1600, 1601, 1614, 1632, 1637, 1638, 1646, 1660, 1678, 1704, 1706, 1749, 1755, 1775, 1776, 1779, 1783, 1785, 1793, 1839, 1881, 1882, 1912, 1926, 1953, 1954, 1957, 1971, 1972, 2011, 2016, 2039, 2075, 2076, 2086, 2133, 2195, 2198, 2201, 2258, 2292, 2307, 2310, 2354-2356, 2370, 2383, 2419, 2420, 2424, 2435, 2448, 2473-2475, 2498, 2528, 2545, 2551, 2553, 2605, 2633, 2641, 2679, 2711, 2785, 2855, 2857, 2867, 2887, 2937, 2958, 2995, 3003, 3004, 3008, 3013, 3026, 3028, 3030, 3038, 3041, 3071, 3079, 3084, 3085, 3099, 3113, 3117, 3122, 3125, 3129-3131, 3143, 3148, 3157-3159, 3198, 3207-3209, 3211, 3212, 3215, 3225, 3226, 3231, 3239, 3242, 3255, 3268, 3276, 3288, 3290, 3293, 3294, 3296, 3299, 3305, 3310, 3313, 3314, 3317, 3324, 3327, 3329, 3340, 3341, 3344, 3358, 3359, 3364, 3367, 3370, 3371, 3372, 3375, 3377, 3379, 3386, 3388, 3390, 3392, 3405, 3415, 3424, 3426, 3436, 3437, 3447, 3454, 3455, 3473, 3474, 3476, 3481, 3486, 3488, 3493, 3495, 3507, 3509, 3511, 3537, 3540, 3542, 3544, 3550, 3556, 3557, 3566, 3579, 3588, 3595, 3604, 3625, 3646, 3648, 3663, 3667, 3669, 3685, 3691, 3697, 3698, 3699, 3703, 3746, 3761, 3763, 3768, 3771, 3794, 3811, 3840, 3847, 3848, 3865, 3872, 3876, 3877, 3893, 3894, 3905, 3911, 3922, 3953, 3956, 3969, 3975, 3977, 3987, 3991, 4012, 4033, 4043, 4047, 4075, 4076, 4080, 4083, 4094, 4097, 4098, 4101, 4102, 4117, 4119, 4120, 4122, 4128, 4144, 4147, 4149, 4158, 4164, 4166, 4168, 4170, 4173, 4194, 4206, 4213, 4226, 4238, 4250, 4257, 4278, 4294, 4329, 4333, 4342, 4355, 4362, 4364, 4383, 4384, 4392, 4405, 4408, 4456, 4458, 4485-4489, 4511, 4512, 4514, 4518, 4521, 4526, 4527, 4556, 4559, 4569, 4572, 4576, 4582, 4599, 4600, 4628, 4642, 4643, 4645, 4648, 4652, 4699, 4701, 4704, 4713, 4719, 4738, 4748, 4776, 4796, 4807-4809, 4812, 4814, 4818, 4819, 4824, 4833, 4835, 4839, 4878, 4879, 4901, 4905, 4916, 4928, 4968, 4969, 4971, 4976, 4985, 4987, 4995, 5004, 5005, 5012, 5020, 5022, 5031, 5032, 5037, 5040, 5045, 5047, 5052, 5065, 5069, 5079, 5083, 5099, 5102, 5108, 5109, 5118, 5122, 5131, 5154, 5156, 5164, 5181.

Drainage Needs, Drainage Problems, Drainage Programs, and Books and Bibliographies on More Than One Phase of Drainage

156. Abel, H., and Mehnert, K. YIELD INCREASE THROUGH HYDRO IMPROVEMENT. (Ge) Berlin, Deutscher Landwirtschaftsverlag. 223 pp. Ref. (Die Dorfakademie No. 1) 1962. 54 Ab3

157. Adrien, J., and Fanfan, R. DO YOU KNOW WALSH? (Fr) B. Agr. [Port-au-Prince] 5(3): 1-5. Apr./June 1956. 8 B87

158. Agaev, A. I. RECLAMATION MEASURES FOR IMPROVING THE WATER REGIME OF TEA PLANTATION SOILS WITH EXCESS MOISTURE IN LENKORAN AREA. (Rus) Akad. Nauk Azerbaidzhansk. SSR. Dok. 11: 405-413. 1955. 511 Ak147D

159. Agaev, A. I. SURFACE RUNOFF UNDER CONDITIONS OF EXCESSIVE SOIL MOISTURE. (Az) Akad. Nauk. Azerb. SSR. Isv. 1957(4): 125-133. Apr. 1957. 511 Ak147
Russian summary.

160. Akhtyrtsev, B. P., and Yarovenko, V. V. SUBMERGED SOILS OF THE RIVER DON FLOOD PLAIN. (Rus) Nauch. Dok. Vysshei Shkoly. Biol. Nauki. 1962(2): 178-184. 1962. 442.8 N22

161. Alpat'iev, S. M. ed. DRAINAGE AND IRRIGATION OF LANDS. (Rus) Kyiv, Derzhavne Vydavnytstvo Silskohospodarskoi Literatury. 383 pp. (Biblioteka Kolhospnoho Ahronoma) 1956. 54 AL7

162. Amaya-Brondo, A., and Robles-Espinosa, J. OFFICES OF IRRIGATION AND DRAINAGE ENGINEERING. (Sp) Ingen. Hidraul. en Mex. 17(4): 27-44. Oct./Dec. 1963. 290.8 In43
English summary, buff pages, p.I-II.

Various projects of the office of irrigation and drainage engineering in Mexico were described and illustrated.

163. Arakeri, H. R., Chalam, G. V., Satyanarayana, P., and Donahue, R. L. SOIL MANAGEMENT IN INDIA. Ed. 2. Asia Publishing House. 609 pp. 1962. 56.25 Ar1

In this book of soil management in India, several chapters were devoted to drainage, irrigation, salinity control, soil and water conservation, and soil genesis and classification.

164. Aslyng, H. C. NATURAL BEAUTY, RECLAMATION, DRAINAGE, AND WATER BALANCE. (Da) Hedeselsk. Tidsskr. 80(14): 303-312. Nov. 15, 1959, 11 H35

165. Baak, B. C. P. H. Van. LAND RECLAMATION AND IMPROVEMENT—A READING LIST: (SUPPLEMENT TO THE 1960 ANNUAL REPORT). Wageningen, Internatl. Inst. for Land Reclam. and Improvement. 30 pp. 1961. 54.9 In8A

A bibliography was given on land reclamation and improvement. Papers on drainage and irrigation were included.

166. Baathe, A. ON THE NEED FOR DRAINAGE OF FARM LAND IN THE PROVINCE. (Sw) Lantbrtidskr. f Jamtland och Harjedalen. 8(3): 9-11. 1955. 11 L293

167. Baeker, U. DRAINAGE OF SANDY SOILS IN NORTH GERMANY. (Ge) Wasser u. Boden. 13(11): 381-383. Nov. 1961. 56.8 W28

168. Bakhulin, M. D. LAND IMPROVEMENT BY DRAINAGE AND ITS PROBLEMS IN IAKHROMA BASIN OF MOSCOW REGION. (Rus) Zemledelie. 5(8): 26-32. Aug. 1957. 20 Z44

169. Bardelli, U. HYDRO-AGRICULTURAL TRENDS. (It) Cron. Econ. 229: 15-19. maps. Jan. 1962. 280.8 C882

170. Basse, N. DRAINAGE WORK IN FREDERIKSBORG PROVINCE. (Da) Danske Hedeselsk. Hedeselsk. Tidsskr. 76: 305-316. Oct. 15, 1955. 11 H35

171. Battistelli, E. PROTECTION OF AGRICULTURE FROM CLIMATIC ADVERSITIES. (It) Cron. Econ. 226: 33-37. Oct. 1961. 280.8 C882

172. Bennett, H. H. ELEMENTS OF SOIL CONSERVATION. Ed. 2. McGraw-Hill Book Co., 358 pp. 1955. 56.7 B43E

A revised book was given on the elements of soil conservation. Many of the chapters discussed material that was directly or indirectly related to drainage.

173. Berg, K. WATER MANAGEMENT IN HESSE. (Ge) Wasser u. Boden. 7: 237-245. Aug. 1955. 56.8 W28

174. Bevilacqua, I. KNOTS IN THE COMB. (It) Nuova Agr. Lucana. 6(8): 115-117. Aug. 1958. 16 N923

175. Bjarnarson, B. DRAINAGE. (Ic) Freyr. 56(6/7): 94-96. Mar./Apr. 1960. 11 F89

176. Bloemen, G. W. WATER CONTROL ON MEADOWS. (Du) Nederland. Heidemaatsch. Tijdschr. 68(4): 83-91. Apr. 1957. 12 N282

177. Borisenko, A., and Pronin, A. ECONOMIC IMPORTANCE OF THE IMPROVEMENT OF WATERLOGGED LANDS. (Rus) Ekon. Sel'sk. Khoz. 10: 94-102. Oct. 1964. 281.8 So73

178. Boschma, K. DRAINAGE. (Du) Groenten en Fruit. 16(18): 586-587. Nov. 3, 1960. 80 G89

179. Bouwman, L. H. DRAINAGE. I. (Du) Inzicht. 16(11): 136-138. map. Nov. 1962. 44.8 In9

180. Bouwman, L. H. DRAINAGE. II. (Du) Inzicht. 17(1): 10-12. Jan. 1963. 44.8 In9

181. Bouwman, L. H. DRAINAGE. III. (Du) Inzicht. 17(3): 38-39. Mar. 1963. 44.8 In9

182. Bronitskii, N. I. PRINCIPLES OR CONSERVATISM? (Rus) Khlopkovodstvo. 11: 54-58. Nov. 1962. 72.8 K522

183. Breitenoder, M. REMOVAL OF UNDERGROUND WATER AND SOIL MOISTURE. (Ge) Oesterr. Wasserwirt. 13(5/6): 90-93. May/June 1961. 55.8 Oe8

184. Brudastov, A. D., and Shaumian, V. A. DRAINAGE OF MINERAL AND MARSHY LANDS. Ed. 4. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury. 442 pp. Ref. 1955. 54 B832

185. Calzecchi-Onesti, A. CONDITIONS FOR DRAINAGE. (It) Gior. di Agr. 66: 77. Feb. 26, 1956. 16 It1G

186. Calzecchi-Onesti, A. DRAINAGE IN ITS POSSIBILITIES OF APPLICATION. (It) Gior. di Agr. 66: 181-182. May 13, 1956. 16 It1G

187. Ceskoslovenska Akademie Zemedelskych Ved. CONFERENCE ON IRRIGATION AND DRAINAGE OF SOILS, WITH INTERNATIONAL PARTICIPATION. (Rus) Za Sotsialist. Sel'skokhoz. Nauk. 1959(2): 117-216. 1959. 64.8 Z1

188. Chamski, R. DRAINAGE OF CULTIVATED LAND IN POLAND. (Pol) Wiad. Melior. i Lakarskie. 6(1): 15-17. Jan./Feb. 1963. 54.8 W63

189. Colonial Sugar Refining Co. THE DRAINAGE OF SUGAR CANE LANDS IN N.S.W. [Sydney]. 16 pp. 1957. 65 C712D

A guide was given on the need and use of drainage for sugar cane land in New South Wales, Australia.

190. Colonial Sugar Refining Co. DRAINAGE OF SUGAR CANE LANDS IN N.S.W. [Sydney]. 16 pp. 1962. 65 C712D

A revised guide was given on the need and use of drainage for sugar cane lands in New South Wales, Australia.

191. Cook, R. L. SOIL MANAGEMENT: FOR CONSERVATION AND PRODUCTION. John Wiley and Sons, Inc. 527 pp. 1962. 56.22 C77

In this textbook on soil management, several chapters were included on drainage, irrigation, salinity control, water conservation, and different types of soil management that includes the above—especially organic and forest soils.

192. Dabrowski, J. METHODS OF DRAINAGE OF ARABLE LAND IN THE USA. (Pol) Wiad. Melior. i Lakarskie. 5(1): 11-15. Jan./Feb. 1962. 54.8 W63

193. Daelman, P. DRAINAGE OF HORTICULTURAL SOILS. (Fl) Tuinbouwberichten. 24(10): 239-242. Oct. 15, 1960. 80 T817

194. Daishev, T. I. UTILIZATION OF DRAINAGE SYSTEMS. (Rus) [Leningrad] Lenizdat. 154 pp. 1964. 54 D14

195. Daishev, T. I., and Sannikov, G. P. OPERATION OF DRAINAGE SYSTEMS. (Rus) Leningrad, Lenizdat. 155 pp. 1964. 54 D14

196. Davey, L. CSIRO WATER RESEARCH BIBLIOGRAPHY, 1923-1963. Melbourne. 98 pp. 1964. 241.6 Au7

A water research bibliography was given for the period 1923-1963 by the Commonwealth Scientific and Research Organization of Australia.

197. Davis, E. G., and Gould, M. L. DRAINAGE OF AGRICULTURAL LAND—A BIBLIOGRAPHY OF SELECTED REFERENCES. U.S. Dept. Agr. Misc. P. 713, 200 pp. May 1956. 1 Ag84M

An annotated bibliography was given of selected articles published between 1936-1955 on drainage of agricultural lands.

198. Deetjen. WATER MANAGEMENT AND TILLAGE IN "GRUNEN PLAN" AND "KUSTEN PLAN". (Ge) Wasser u. Boden. 10(7/8): 228-230. July/Aug. 1958. 56.8 W28

199. Dewall, E. W. THE IMPORTANCE OF DRAINAGE IN CONSERVATION. Iowa Soil and Water 5(11): 26. Jan. 1958. 290.8 Io9

A report was given on the importance of drainage in the Winnebago Soil Conservation District in Iowa. The area originally had many small ponds, large ponds, and lakes. Open ditches and later tile were used to drain the small ponds and some of the larger ponds and lakes. The costs of draining the area completely was too large for individual farmers. The drainage district approach was not successful. The problem was finally solved by the combination of cost sharing of A.C.P. and the engineering assistance of S.C.S.

200. Dobrowolski, L. J. ON SOME PROBLEMS OF WATER MANAGEMENT AND IMPROVEMENT WORKS IN SWITZERLAND. (Pol) Wiad. Melior. i Lakarskie. (5): 146-149. maps. Sept./Oct. 1962. 54.8 W63

201. Dobrowolski, L. J. PROBLEMS OF WATER MANAGEMENT AND LAND IMPROVEMENT OF THE SEASHORE AREA OF JUTLAND AND THE DANISH ISLANDS. (Pol) Wiad. Melior. i Lakarskie. 5(6): 170-174. map. Nov./Dec. 1962. 54.8 W63

202. Donat, J. PROBLEMS OF SOIL DRAINAGE IN ALPINE AREA. (Ge) Oesterr. Wasserwirt. 10(8/9): 165-171. Aug./Sept. 1958. 55.8 Oe8

203. Donnan, W. W. DRAINAGE AND WATER MANAGEMENT RESEARCH IN WESTERN EUROPE. Amer. Soc. Civil Engin. Trans. 126(3): 12-18. 1961. 290.9 Am3

A report was given of a 3-week study tour of drainage and water management research in Great Britain, Denmark, and the Netherlands.

204. Edminster, T. W. NEED FOR NEW AND CREATIVE RESEARCH IN IRRIGATION AND DRAINAGE. J. Irrig. and Drain. Div., ASCE 90(Ir4): 18-23. Dec. 1964. 290.9 Am3Ps

A discussion was given on the need for new and creative research in irrigation and drainage.

205. Elmdahl, K. J. DRAINAGE AND NATURE PROTECTION. (Sw) Tidskr. f. Hushsallsk. och Skogsvardsstyr. i Gavleborgs Lan. 32(2): 61-62, 68-69. 1956. 11 T434

206. Etchevehere, P. H. OUTLINE OF GEOMORPHOLOGICAL REGIONS AND DRAINAGE OF THE ARGENTINE REPUBLIC. (Sp) IDIA 162: 7-26. map. Ref. June 1961. 9 Id3

207. Fernandez, M. B. DRAINAGE IN THE FIELD. (Fr) Plan Chillan. 4(12): 7-11. 1958. 281.8 B63

208. Fialkovskii, P. G. DRAINAGE OF SWAMPED MINERAL SOILS IN THE FAR EAST. (Rus) Gidrotekh. i Melior. 1962(7): 47-53. July 1962. 290.8 G362

209. Foster, A. B. APPROVED PRACTICES IN SOIL CONSERVATION. Ed. 3. The Interstate Printers and Pub., Inc. 384 pp. Ref. 1964. 56.7 F81

A revised edition was given on a publication on approved practices in Soil Conservation. Several chapters were included that related directly or indirectly to drainage.

210. France Direction de la Documentation. UTILIZATION OF THE MEDJERDA VALLEY. (Fr) France Dir. de la Doc. Notes et Études Doc. 2089, 24 pp. Oct. 20, 1955. 280.9 F843

211. Fretay, M. E. THE PROBLEMS OF DRAINAGE AND METHODS OF CULTURE IN GRANDE-TERRE. (Fr) Rev. Agr. Sucr. et Rhumiere des Antilles Franc. 2(2): 87-89. Apr./June 1957. 65.8 R327

212. Frobe, A. THE OPENING OF THE GOTTES-POLDERS. (Ge) Landliche Neuordnung in Schleswig-Holstein; Beitrag zur Fruhjahrstagung in Kiel. Gottingen. 9(11): 43-44. map. June 1960. 281.175 Ag83

213. Gaastra, G. CULTURE TECHNIQUE. I. (Du) Landbouwnieuws. 11(4): 39-41. Apr. 1959. 9.6 L232

214. Garev, E. ISRAEL'S DRAINAGE PROBLEMS. Water Planning for Israel P.N. 288: 1-10. June 1962. 54 W29

A discussion was given of drainage problems in Israel.

215. Georgescu, I. CERTAIN PROBLEMS CONCERNING FUNDAMENTAL IMPROVEMENTS IN DOUBROUJDA. (Rum) Prob. Agr. [Bucuresti] 10(12): 79-86. maps. Dec. 1958. 21 R862

216. Georgiev. A. V., and Florent'ev, L. I. eds. A YEAR'S WORK IN RECLAMATION OF VIRGIN SOILS AND WASTELAND IN ALTAI TERRITORY. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennol Literatury. 436 pp. 1955. 54 G292

217. Gertman, B. G. DRAINAGE OF AGRICULTURAL LANDS. (Rus) Moskva, Gos. izd-vo selkhoz lit-ry. 250 pp. 1955. 54 G2730

218. Godinache, J. VIEWS OF DRAINAGE WORK IN BELGIUM. (Fr) Ann. de Gembloux. 65(3): 204-207. Third Q. 1959. 13 G28

219. Graeber, W. FOLLOWING THE LONG WINTER: WHAT'S TO BE DONE? (Ge) Mitt. der Deut. Landwirt.-Gesell. 78(14): 448-489. Apr. 4, 1963. 18 N39

220. Graham, E. H., and Van Dersal, W. R. WATER FOR AMERICA: THE STORY OF WATER CONSERVATION. Oxford U. Press, Fair Lawn, N. Y. 112 pp. 1956. 292 G76

A widely illustrated "popular type" book was given on water conservation in America. Chapters were included on water rights, irrigation, drainage, water erosion, floods, etc.

221. Great Britain Ministry of Agriculture, Fisheries and Food. LAND DRAINAGE IN ENGLAND AND WALES; PRESENTED TO PARLIAMENT BY THE MINISTER OF AGRICULTURE, FISHERIES AND FOOD BY COMMAND OF HER MAJESTY DECEMBER 1959. London (Gt. Brit. Parliament. Papers by Command 916) 12 pp. 1959. 54 G795

A report was given on land drainage in England and Wales.

222. Grimsson, K. OBSERVATIONS ON DRAINAGE. (Ic) Freyr. 51: 168-170. May/June 1955. 11 F89

223. Gubar', N. S. INNOVATION IN DRAINAGE OF MINERAL SOILS. (Rus) Vsesoiuzn. Obshch. Po Rasprostraneniiu Polit. I Nauch. Znan i. [Broshiury-Stenogrammy Lektsii] Ser. 5, [Sel'skokhoz] Ser. 8, 30 pp. 1958. 20 V97

224. Gubar', N. S., Krivonosov, I. M., Rozin, V. A., and Seliverstov, M. N. AGRICULTURAL MELIORATION IN THE NON-CHERNOZEM SOILS AREA. (Rus) Moskva, Kolos. 391 pp. 1964. 54 G93

225. Gunthart, A. DRAINAGE OF THE CULTIVATED LAND. (Ge) Grune. 88(23): 688. 1960. 17 Sch9

226. Haase, H. REMOVAL OF ACCUMULATED MOISTURE. (Ge) Tech. u. Landwirt. 9(11): 250-251. June 10, 1957. 58.8 T223

227. Hakansson, A. DRAINAGE PROBLEMS IN SKANE. (Sw) Centstyr. f. Malmohus Lans Forsoks-och Vaxtxkyddsringar. Meddel. 29: 127-131. 1962, pub. 1963. 64.9 C332

228. Harildstad, E. BIG AREAS NEED DITCHING. (Sw) Norske Myrselsk. Meddel. 55(6): 217-218. 1957. 11 N813

229. Harrison, R. W. ALLUVIAL EMPIRE. I. Little Rock, Ark., Delta Fund. 344 pp. 1961. 282.12 H242

A discussion was given on an economical study of the Mississippi Delta in Arkansas. One of the six chapters was devoted to land drainage and another to land forming for drainage and irrigation. Soil types and food control was also stressed.

230. Hayashi, M., Konaka, N., and Igarashi, G. ECOLOGICAL STUDIES OF RICE PLANTS IN DIFFERENT CULTIVATING PERIOD. III. ON THE GROWTH OF EARLY-TRANSPLANTING RICE PLANTS CULTURED IN WORSE-DRAINED PADDY FIELD. (Ja) (Abs.) Crop Sci. Soc. Japan. Proc. 25(4): 234-235. July 1957. 22.5 C88

231. Hellinga, F. WATER MANAGEMENT PROBLEMS. (Du) Nederland. Heidemaatsch. Tijdschr. 66: 252-262. Oct. 1955. 12 N282

232. Hsu, C. IRRIGATION, DRAINAGE, AND PLANNED WATER SUPPLY. (Ch) Peking, Chung-kuo kung yeh ch'u pan she. 318 pp. 1963. 55 H852

233. Hulsbos, W. C. PROBLEMS OF DRAINAGE IN THE UNITED ARAB REPUBLIC. (Du) Nederland. Heidemaatsch. Tijdschr. 75(1): 6-12, 31-40. map. Jan. 1964. 12 N282

234. Iakolev, B. I. METHODS OF RECLAMATION OF THE HARD MINERAL SOILS UNDER CONDITIONS OF BELORUSSIAN SSR. (Rus) Belorusskaia Sel'skokhoz. Akad. Trudy. 20: 86-98. Ref. 1954. 106 B415

235. Iakovlev, B. I. RECLAMATION OF THE EXCESSIVELY WET MINERAL SOILS UNDER BELORUSSIA SSR CONDITIONS. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, Minsk, 1956. pp. 202-209. 1956. 54.9 K83

236. Ignatenok, F. V. SOIL DRAINAGE. (Rus) Sadovodstvo. 9: 18-19. Sept. 1964. 80 Sa13

237 Irrigation and Drainage Division Research Committee. IRRIGATION AND DRAINAGE RESEARCH CONFERENCE, UTAH STATE UNIVERSITY, 1964. J. Irrig. and Drain. ASCE 90(IR4): 1-106. Dec. 1964. 290.9 Am3Ps

Abstracts of the principal addresses and summary reports of panel discussions were given for the Irrigation and Drainage Research Conference conducted at Utah State University on March 19-21, 1964.

238. Israelsen, O. W., and Anderson, B. M. WORLD PROBLEMS IN IRRIGATION AND RECLAMATION OF WATERLOGGED LANDS. Cong. Irrig. and Drain. Trans. 4(2): 11.145-11.174. Ref. 1960. 55.9 C7652

A discussion was given on world problems in irrigation and reclamation of waterlogged lands. The major cause of waterlogging of arid-region lands were described. Example of drainage in the western arid-region states in the United States were reviewed.

239. Iunevich, D. P. UTILIZATION OF DRAINAGE SYSTEMS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury. 93 pp. Ref. 1955. 54 Iu8E

240. Jager, A. W. De. DRAINAGE IN HORTICULTURE. (Du) Nederland. Heidemaatsch. Tijdschr. 72(6): 138-144. June 1961. 12 N282

241. Jaguszewski, T. THE PROBLEM OF PRODUCTIVITY AND EMPLOYMENT OF WORKERS IN WATER AND LAND IMPROVEMENT ENTERPRISES. (Pol) Wiad. Melior. i Lakarskie. 5(2): 35-38. Mar./Apr. 1962. 54.8 W63

242. Jaguszewski, T. EMPLOYMENT PROBLEMS IN WATER MANAGEMENT AND LAND IMPROVEMENT ENTERPRISES. (Pol) Wiad. Melior. i Lakarskie. 6(2): 38-41. Mar./Apr. 1963. 54.8 W63

243. Jaworski, J. IS THERE A REAL OR APPARENT INCOMPARABILITY BETWEEN WATER MANAGEMENT AND LAND IMPROVEMENT WORKS AND THE PROTECTION OF NATURE? (Pol) Postepy Nauk Roln. 9(5): 67-78. Sept./Oct. 1962. 20.5 P84

244. Johnson, A. G. GENERAL SURVEY OF THE PROBLEM OF LAND DRAINAGE AND IRRIGATION. Farm and Garden Contract. 3(1): 12-16. June 1963. 58.8 F227

A general survey was given on past to present problems of land drainage and irrigation in Great Britian.

245. Jong, A. De. HOW DO I DISPOSE OF INVESTMENT COSTS FOR A YOUNG ORCHARD? (Du) Nederland. Fruittelers Organ. Berbl. 18(12): 332. Dec. 1962. 95.9 N28

246. Jonsson, A. L. DRAINAGE. (Ic) Freyr. 57(15/16): 243-246. Aug. 1961. 11 F89

247. Juusela, T. DRAINAGE ACTIVITIES. (Sw) Nord. Jordbrforsk. Sup. 2: 199-207. 1960. 11 N752

248. Juusela, T., and Ware, M. DRAINING CONDITION OF THE CULTIVATED FIELDS IN FINLAND. (Fi) Maa- ja Vesitek. Tutkimusksia 8, 89pp. Ref. 1956. 56.8 M11

249. Juva, K. LAND IMPROVEMENT. (Cz) Praha, Ceskoslovenska Akademie Zemedelskych Ved. 355 pp. maps. Ref. 1962. 54 J98

250. Kano, T. LECTURES ON AGRICULTURAL CIVIL ENGINEERING. (Ja) Tokyo, Askura Shoten. 252 pp. 1960. 290 K132N

251. Kano, T. IRRIGATION AND DRAINAGE. I. (Ja) Han. Tokyo, Yoken-Do. 464 pp. 1964. 55 K133

252. Karnes, L. B. RECLAMATION OF WET AND OVERFLOW LANDS. In Smith, G. O., ed. CONSERVATION OF NATURAL RESOURCES. Ed. 2. Wiley., N.Y. pp. 116-126. maps. Ref. 1958. 279.12 Sm5

A report was given on the reclamation needs and accomplishments on wet and overflow lands in the United States.

The author concluded that there is no need for the drainage of new land to provide food, fiber, and raw materials for the people of our country at the present time. There are, however, many individual farmers and some communities that would profit by the drainage and improvement of agricultural lands in local areas.

253. Kellermann, J. PROBLEMS OF AGRICULTURAL AND RURAL HYDRAULICS OF THE IVORY COAST. (Fr) Cahiers des Ingen. Agron. 154: 28-31. Mar. 1961. 14 C112

254. Kevers, G. GENERAL PRINCIPLES OF LAND IMPROVEMENT. II. (Fr) B. Agr. du Congo. 52(3): 487-523. June 1961. 24 K83

255. Kowalczyk, A. LAND IMPROVEMENT PROBLEMS OF THE LEBA RIVER VALLEY. (Pol) Nowe Roln. 11(19): 25-26. Oct. 1, 1962. 20.5 N86

256. Krivonosov, L. M., and Muratkhan, V. P. ORGANIZATION AND PERFORMANCE OF DRAINAGE WORKS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury. 86 pp. 1958. 54 K8920

257. Kubyshkin, P. P., and Poluboryarinov, I. I. AGRICULTURAL MELIORATION AND FORESTRY. (Rus) Moskva, Kolos. 335 pp. Ref. 1964. 54 K952

258. Kuntze, H. HOW SHALL WE DRAIN GRASSLAND? (Ge) Tech. u. Landwirt. 12(8): 178-180. Apr. 25, 1960. 58.8 T223

259. Kuntze, H. TWENTY QUESTIONS ON DRAINAGE. (Ge) Mitt. der Deut. Landwirt.-Gesell. 75(23): 760-762. (Cont.) June 9, 1960. 18 N39

260. Kuntze, H. TWENTY QUESTIONS ON DRAINAGE. (Ge) Mitt. der Deut. Landwirt.-Gesell. 75(24): 781-783. (Cont.) June 16, 1960. 18 N39

261. Larsen, E. TIME FOR PLANTING. (Da) Erhvervsfrugtavleren. 31(10): 378-380. Oct. 1, 1964. 80 Er3

262. Lauciani, E. FARM DRAINAGE. (It) Genio Rur. 19: 1071-1081. Oct. 1956. 281.8 R522

263. Leitman, B. G., and Pisar'kov, K. A. DRAINAGE OF AGRICULTURAL LANDS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury. 250 pp. 54 G2730

264. Leue, P. MELIORATIONS ON HEAVY SOILS. (Ge) Deut. Agrartech. 9(4): 170-171. Ref. Apr. 1959. 58.8 D482

265. Levanovskii, L. B. DRAINAGE OF WATERBOGGED LAND. (Rus) Priroda [Moscow] 1962(2): 73-78. Feb. 1962. 410 P933

266. Levanovskii, L. B., and Stankevich, V. S. IMPROVEMENT OF SWAMPY LANDS; PAPERS. (Rus) Moskva, Sel'khozizdat. 126 pp. 1962. 54 L57

267. Lhotsky, J. IMPROVEMENT OF SOILS BEFORE AFFORESTATION. I. (Cz) Praha, Statori zemedelske nakl. 213 pp. 1962. 99.47 L61

268. Li, C. M. THE INFLUENCES ON SOIL FERTILITY OF DRAINING THE FIELDS DURING WINTER IN CH'IUNG-LAI HSIEN. (Ch) Acta Pedol. Sinica. 10(3/4): 258-266. Sept./Dec. 1962. 56.9 Ac8 Russian summary.

269. Liger, P. UTILIZATION OF THE ANCIENT LAKE FETZARA. (Fr) Soc. des Agr. d'Algerie. B. 100(603): 172-182. 1955-56. 24 Sol

270. Lindqvist, R. DRAINAGE ACTIVITIES IN MALMOHUS PROVINCE. (Sw) Malmohus Lans Hushsallsk. Kvrtlskr. 2: 150-154. 1963. 11 M29

271. Lint, H. Van. DRAINAGE IN THE NURSERY CENTER AT BOSKOOP. (Du) Boskoop. Ver. Proefsta. v. de Boomkwekerij. Jaarb. 1961: 56-58. 1961. 86 B65

272. Lint, H. Van, and Vogel, P. De. DRAINAGE IN THE NURSERY CENTER BOSKOOP. (Du) Boskoop. ver. Proefsta. v. de Boomkwekerij. Jaarb. 1958: 90-97. 1958. 86 B65

273. Livesley, M. C. FIELD DRAINAGE. London. (Span's Agr. Ser.) 187 pp. 1960. 54 L75

The specialized knowledge of field drainage was given from the early history down to present day drainage in Great Britian.

274. Lluch-Figueroa, E. DRAINAGE IN THE LAJAS VALLEY. (Sp) Rev. de Agr. de P. R. 51(1): 224-225. Jan./June 1964. 8 R325

275. Malherbe, I. deV. SOIL FERTILITY. Ed. 4. Oxford U. Press. 304 pp. 1962. 56 M29Ae

This fourth English edition deals with soil problems in South Africa. Several chapters in the book were devoted to drainage, irrigation, reclamation of saline soils, soil physics, soil chemistry, and soil genesis and classification.

276. Martinez, E. R. REPARATION AND DRAINAGE OF SOILS. (Sp) B. Azucarero Mex. 116: 7-11. Feb. 1959. 65.8 B63

277. Maslarzowa, B. BIBLIOGRAPHY OF SCIENTIFIC AND POPULAR-SCIENTIFIC WORKS OF THE CHAIRS OF THE WYDZIAL MELIORACJI WODNYCH OF WSR [WYZSZA SZKOLA ROLNICZA] IN CRACOW. (Pol) Krakow. Wyzsza Roln. Zesyty Nauk. Melior. 1(17): 115-137. 1963. 54.9 K85

278. Meijering, K. DRAINAGE. (Du) Netherlands. Rlandbconsschap. Westelijk Drenthe. Verslagen en Meded. 1958: 26-31. 1958. 12 N389

279. Merbitz, H. DRAINAGE, IRRIGATION, AND EROSION. (Ge) Deut. Landwirt.-Gesell. Mitt. 73(23): 607-609. June 5, 1958. 18 N39

280. Merbitz, H. A HEALTHY SOIL REDUCES DAMAGES CAUSED BY MOISTURE AND DROUGHT. (Ge) Mitt. der Deut. Landwirt.-Gesell. 75(24): 779-781. June 16, 1960. 18 N39

281. Merbitz, J. SOIL AND WATER. (Ge) Mitt. der Deut. Landwirt.-Gesell. Illus. Beilage 10, 8 pp. Oct. 22, 1959. 18 N39A

282. Moltesen, P. COMMENTS ON THE SKJERNA DRAINAGE. (Da) Hedeselsk. Tidsskr. 75(3): 66-71. Mar. 10, 1963. 11 H35

283. Montgomery, R. C. DRAINAGE PROBLEMS OF THE MIDDLE WILLAMETTE VALLEY. Diss. (Abs.) 23(8): 2867. Feb. 1963. 241.8 M58

An abstract was given on drainage problems of the middle Willamette Valley and the needs for both partial and complete drainage systems for farms in the area.

284. Nefedov, V. V. FOR A BETTER UTILIZATION OF FLOOD LANDS. (Rus) Kartofel' 3(6): 25-28. Nov./Dec. 1958. 75.8 K147

285. Netherlands Directie Van De Landbouw. GET RID OF SUPERFLUOUS WATER. (Du) Netherlands. dir. van de Landb. Vlugschr. v. de Landb. 69, 2 pp. 1956. 12 N38Vs

286. Nielsen, T. P. DRAINAGE PROBLEMS: REPORT ON A STUDY TRIP TO U.S.A. IN 1951 (TA33-36). (Du) Kobenhavn, Udenrigsministeriet. 66 pp. (Teknisk Bistand under Marshallplanen) 1954. 54 N55

287. Norrgard, A. SOIL, DRAINAGE, IRRIGATION AND CARE OF HUMUS. (Sw) Grundforbattring. 9(3): 141-153. 1956. 54.8 G92
English summary, pp. 178.

A review was given of the meeting and excursion in Sweden during July 1956 by the Soil Section of the Scandinavian Society of Agricultural Research.
Drainage in Sweden was discussed along with soil, irrigation, and care of humus.

288. Novikoff, G. CONSIDERATIONS ON THE NECESSITY FOR DRAINAGE IN PALM PLANTATIONS. (Fr) Tunis. Ecole Natl. Super. d'Agr. B. B. Trimes. 4: 43-49. June 1964. 24 T838

289. Obermeier, H. C. BETTER DRAINAGE MEASURES ELIMINATE WATER DAMAGES. (Ge) Deut. Landwirt.-Gesell. Mitt. 72(15): 360-361. Apr. 11, 1957. 18 N39

290. Offengenden, S. R., Panadiadi, A. D., and Yarushin, M. I. OPERATION OF HYDROMELIORATIVE PROJECTS. (Rus) Moskva, Izdatel'stvo Selskokhozyaistvennoi Literatury, Zhurnalov i Plakatov, 494 pp. Ref. 1962. 54 Of2

291. O'Neill, J. L. THE VITAL FLOW. Development. 32: 44-45, 47-49. Spring 1961. 280.8 D49

A report was given on the importance of arterial drainage in Ireland. Twenty-six catchment drainage schemes were described.

292. Pendleton, R. A. DRAINAGE FOR CACAO PLANTATIONS; THE ORGANIZATION OF DRAINAGE DISTRICTS. (Sp) Cacaotero. 4(2): 1-3. Oct. 1961. 68.38 C113

293. Penskoi, I. K. DRAINAGE AND THE STATUS OF LANDS IN THE KURA-ARAKSIN PLAIN. (Rus) Gidrotekh. i Melior. 9(6): 11-24. June 1957. 290.8 G362

294. Plyusnin, I. I. RECLAMATIVE SOIL SCIENCE. Foreign Languages Pub. House., Moscow. 398 pp. 1950. 56 P71Ae

An English translation was given of this book on Reclamative Soil Science orginally published in Russian in 1960. This soil science book contains several chapters related to drainage, irrigation, and reclamation of saline soils as well as chapters on soil physics, soil chemistry, and soil genesis and classification.

295. Pochvennyi Institut Imeni V. V. Dokuchaeva. IMPROVEMENT OF SOILS IN THE KURA-ARAS LOWLAND. (Rus) Moskva, Izdvo Akademii Nauk SSSR, 243 pp. 1962. 54 P753Me

296. Post, J. J., and Struyk, W. SOIL TREATMENT IN YOUNG FRUIT STANDS IN UTRECHT PROVINCE. (Du) Groenten en Fruit. 18(45): 1803. May 15, 1963. 80 G89

297. Preside, G. L. DRAINAGE OF CLAY SOILS OF THE SELE PLAIN. (It) Salerno. Cam. de Com. Indus. e Agr. Salerno B. Mens. 10(9): 3-14. Sept. 1955. 287 Sa32

298. Press, H. MAINTENANCE AND OBTAINMENT OF IMPROVED LAND BY WATER MANAGEMENT AND HYDROLOGICAL MEASURES. (Ge) Berlin Parey, 372 pp. maps. Ref. 1959. 54 P92

299. Purdue University Agricultural Extension Service. INDIANA FARM DRAINAGE GUIDE. Purdue U. Ind. Agr. Ext. Mimeo ID 55, 58 pp. map. Jan. 1962. 275.29 In2Id

A farm drainage guide was given for Indiana.

300. Ramirez, A. R., and Arancibia, A. G. POSSIBILITIES OF INCREASING THE AGRICULTURAL AREA OF REGIONS NEAR CONCEPCION. (Sp) (Extr.) Simiente. 27(1/4): 39-40. 1957, pub. 1958. 9.3 Si4

301. Rao, M. S. V. R. SOIL CONSERVATION IN INDIA. Indian Council of Agr. Res. 280 pp. 1962. 56.7 R14

In this book on soil conservation in India, many phases were discussed that directly or indirectly concern drainage.

302. Retvedt, K. RESEARCH AT ELVESTAD IN LANGENES. (No) NyJord. 47(1): 21-28. 1960. 282.28 N98

303. Richey, C. B., Jacobson, P., and Hall, C. W. eds. AGRICULTURAL ENGINEERS HANDBOOK. McGraw Hill Book Co. 880 pp. 1961. 290 R393

A handbook was given on the basic theory and practice for the various areas of agricultural engineering. One section was devoted to Soil and Water Conservation and included chapters on drainage, terraces and diversions, waterways, and water law.

304. Rivers and Water Supply Commission Victoria, Australia. OVERSEAS RESEARCH AND PRACTICE IN IRRIGATION AND DRAINAGE. Melbourne. Brooks. 67 pp. 1961. 55 V6620

A report was given on the research and practices of irrigation, drainage, and reclamation in the United States, Great Britian, and the Netherlands. The channel maintenance methods for the three countries were given.

305. Rof-Codina, J. POLDERS OF GALICIA. (Sp) Cult. Mod. 38: 298-299. Aug. 1955. 15 C89

306. Rozin, V. A. DRAINAGE OF THE MINERAL, EXCESSIVELY WET SOILS BY THE APPLICATION OF SOIL-IMPROVING MEASURES. (Rus) In KONFERENTSIIA PO MELIORAFSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, pp. 210-216. Minsk. 1956. 54.9 K83

307. Rusinov, I. SOME TECHNICAL AND ECONOMIC QUESTIONS OF THE RECONSTRUCTION AND EXPLOITATION OF DRAINAGE SYSTEMS IN THE USSR. (Rus) Za Sotsialist. Sel'skokhoz. Nauk. 1959(2): 133-166. 1959. 64.8 Z1

308. Russell, E. W. SOIL CONDITIONS AND PLANT GROWTH. Ed. 9. 688 pp. 1961. 56.3 R91S

A revised edition was given on the classical publication on soil conditions and plant growth. Some of the factors discussed that were related to drainage are: (1) Water in soils; (2) water and plant growth; (3) the transfer of water from soil to plant; (4) the control of soil moisture by drainage; (5) the effect of soil acidity and alkalinity on plant growth; (6) soil formation; (7) effect of topography on soil formation; (8) saline and alkaline soils; and (9) the management of irrigated saline and alkali soils.

309. Salvatore, M. REFRESHER COURSE ON LAND DRAINAGE. (It) Nuova Agr. Lucana. 5(7): 99-102. July 1957. 16 N923

310. Sanders, M. REGULAR CONTROL OF DRAINAGE. (Du) Netherlands. Dir. van de Landb. Verslag van het Landbk. Onderz. in Noordelijk-Groningen. 1957: 100-101. 1957. 12 N38Vg

311. Savarenskii, A. D. MOVEMENT OF DEPOSITS AND DEFORMATION OF BEDS IN THE SYSTEM OF CANALS. (Rus) In Akademiia Nauk Sovet po Izucheniiu Proizvoditel'nykh Sil. ISSLEDOVANIIA DEFORMATSII KANALOV I VLIIANIIA OROSHENIIA NA GRUNTOVYE VODY V NIZOV'IAKH AMU-DAR'I. Moskva, Akademiia Nauk SSSR, pp. 47-60. Ref. 1956. 55 Ak131

312. Savarenskii, A. D., and Levanovskii, L. B. FIELD INVESTIGATIONS OF THE DEFORMATIONS OF CANAL BEDS IN AMU-DARYA DOWNSTREAMS. (Rus) In Akademiia Nauk Sovet po Izucheniiu Proizvoditel'nykh Sil. ISSLEDOVANIIA DEFORMATSII KANALOV I VLIIANIIA OROSHENIIA NA GRUNTOVYE VODY V NIZOV'IAKH AMU-DAR'I. Moskva, Akademiia Nauk SSSR, pp. 5-46. Ref. 1956. 55 Ak131

313. Scarduzio, G., and Martinez, A. REGULATION OF HILL LANDS IN SICILY. (It) Acqua e il Suolo. 13(5): 349-360. (Cont.) Sept./Oct. 1961. 55.8 Ac7

314. Schie, J. J. Van, and Paassen, J. T. M. Van. DRAINAGE. (Du) Groenten en Fruit. 20(24): 999. Dec. 16, 1964. 80 G89

315. Schmidt, H. DRAINAGE IN THE COASTAL REGION. (Ge) Landtechnik. 12(12): 363-366. June 30, 1957. 58.8 L235

316. Schulte-Karring, H. DRAINAGE OR SUBSOILING? (Ge) Mitt. der Deut. Landwirt.-Gesell. 78(36): 1119-1122. Sept. 5, 1963. 18 N39

317. Schwab, G. O., Frevert, R. K., Barnes, K. K., and Edminster, T. W. ELEMENTARY SOIL AND WATER ENGINEERING. Wiley., N.Y. 296 pp. 1957. 56.7 Sch92E

An elementary textbook was given on soil and water engineering for classroom and laboratory use for college students. Chapters on terracing, waterways, surface drainage, and tile drainage were included.

318. Seoane, C. E. MEXICO AS I SAW IT. (Sp) Vida Agr. [Lima] 38(447): 67, 69, 71, 73, 75, 77-82. Feb. 1961. 9.8 V66

319. Sharov, I. A. UTILIZATION OF IRRIGATED AND DRAINED LANDS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 56: 5-14. 1960. 20 M857

320. Sheludiak, N. I. SOIL IMPROVEMENT AND FERTILIZATION. (Rus) [Moskva] Moskovskii rabochii, 34 pp. 1964. 54 Sh4

321. Shubladze, K. K., Levanovskii, L. B., and Koklyanov, A. F. BASIC PROBLEMS IN LAND RECLAMATION. (Rus) Gidrotekh. i Melior. 1961(8): 11-20. Aug. 1961. 290.8 G362

322. Skoropanov, S. G. TOTAL AND PROPER UTILIZATION OF DRAINED LANDS. (Rus) Gidrotekh. i Melior. 1961(8): 21-28. Aug. 1961. 290.8 G362

323. Skov, K. S. SOME OBSERVATIONS. DRAINAGE PROBLEMS. (Da) Hedeselsk. Tidsskr. 79(2): 22-25. Feb. 15, 1958. 11 H35

324. Skovborg, H. VESTERSO'S CLAY BANKS BETWEEN LEMVIG AND HARBOORE ARE NOW UNDER THE PLOW. (Da) Hedeselsk. Tidsskr. 78(4): 77-81. Mar. 25, 1957. 11 H35

325. Sleiy, M. V. SOIL DRAINAGE IN IRAQ. (Sum.) Iraq. Min. Agr. Majallatu- 'Zzira'atil-'Iraqiyah. 13(1): 6-7. Jan./Mar. 1958. 22.5 Irl

A summary was given of a report on soil drainage in Iraq.

326. Slojewski, R. LAND IMPROVEMENT PROBLEMS OF THE WROCLAW PROVINCE. (Pol) Nowe Roln. 11(22): 29-32. map. Nov. 15, 1962. 20.5 N86

327. Snijders, J. H. THE NETHERLANDS SILTING PROBLEM. (Du) Netherlands. Rlandbvoorlichtingsdienst. Landbvoorlichting. 17(10): 524-540. maps. Oct. 1960. 12 N383M

328. Soet, F. De. DRAINAGE AND TILLAGE TECHNIQUE AND E 55. (Du) Nederland. Heidemaatsch. Tijdschr. 66: 227-232. Sept. 1955. 12 N282

329. Soet, F. De. BEGGAR-YOUR-NEIGHBOUR POLICY. (Du) Landbk. Tijdschr. 73(4): 125-127. Feb. 1961. 105.2 Or3

330. Soltesz, J. DRAINAGE OF SOILS. (Cz) Bratislava, Slovenske Vydavatel'stvo Podohospodarskej Literatury. (Rastlinna Vyroba, No. 93) 256 pp. maps. Ref. 1961. 54 So4

331. Souza, H. B. De. DRAINAGE: A NECESSITY FOR YOUR FARM. (Por) Lav. Arroz. 14(162): 188-189. June 1960., and 14(163): 230-231. July 1960. 59.8 L39

332. Stallings, J. H. SOIL CONSERVATION. Prentice-Hall, Inc. 575 pp. Ref. 1957. 56.7 Stl

In this book on soil conservation, the following chapters were given that concerns drainage: (1) Water erosion control on cultivated lands; (2) surface water disposal system; (3) planning the farm program; (4) irrigation; (5) farm drainage; and (6) watershed management.

333. Stallings, J. H. SOIL USE AND IMPROVEMENT. Prentice-Hall, Inc. 403 pp. Ref. 1957. 56.7 St1S

In this book on soil use and improvement, the following chapters that concern drainage were given: water erosion control on cultivated land; planning the farm program; farm surface water disposal system; irrigation; soil drainage; and watershed management.

334. Staveren, J. M. Van. FUTURE WORLD FOOD REQUIREMENTS WITH REFERENCE TO THE FACTORS OF LAND AND WATER. (Du) Landbk. Tijdschr. 75(5): 231-245. maps. Ref. Mar. 1963. 105.2 Or3

335. Ster, A. LAND IMPROVEMENT. Ed. 2. enl. (Cz) Praha, Statni Zemedelske Nakl. (Zemedelska Vyroba) 296 pp. Ref. 1961. 54 St43

336. Studii de Hidroamelioratii. STUDIES OF LAND IMPROVEMENTS. I. (Rum) 1963. 54.8 St9

337. Sutton, J. G. DRAINAGE IN THE HUMID AREAS OF THE UNITED STATES. Amer. Soc. Civil Engin. Trans. 122: 115-131. 1956. 290.9 Am3

The extent, needs, and current problems of drainage in the humid areas were given. Improvements and accomplishments of the principal assistance programs were discussed. Examination of the changes brought about by drainage and some brief historical notes were included.

The functions of the various agencies responsible for drainage were described. Further described were the kinds of assistance furnished by technicians of the Soil Conservation Service working through soil conservation districts on drainage problems.

The programs adopted by the states of Louisiana and North Dakota to meet special drainage needs were described.

338. Sutton, J. G. APPRAISING OUR DRAINAGE JOB. Land Impr. 5(4): 7-10. Apr. 1958. 282.8 L224

An appraisal was made of drainage completed in the United States. Over 150 million areas of our best agricultural lands have been improved or reclaimed by drainage. Much of this land produces good crops in years of normal or slightly normal precipitation. However, in years of excessive rainfall, the inadequacies in drainage systems cause widespread crop losses.

339. Sviklis, P. B. RECLAMATION OF OVERMOIST LANDS IN LATVIA. (Rus) Zemledelie. 5: 16-20. May 1963. 20 Z44

340. Swift, A. DITCHING. (No) Landbrdept. Opplysningstjenesten. Smaskr. 5, 38 pp. 1960. 464.4 N83

341. Sys, C. THE SOILS ASPECT IN THE EVENTUAL INCLUSION OF PASTURES IN THE CROP ROTATION. (Fl) Land- en Tuinbouw Jaarb. 17: 31-37. 1962-63. 13 L22

342. Thomas, J. INFORMATION OF A STUDY TRIP IN THE USSR IN MAY 1957. (Ge) Wasser u. Boden. 11(4): 102-109. Ref. Apr. 1959. 56.8 W28

343. Torrecabrera, J. DRAINAGE AND REPARATION OF LANDS. (Sp) Cult. Mod. 43(8): 291-292. Aug. 1960. 15 C89

344. Toshakov, A. D. WORK TECHNOLOGY IN THE IMPROVEMENT OF MEADOWS AND PASTURES. (Rus) Nauka i Peredovoi Opy v Sel'sk. Khoz. 2: 29-31. Feb. 1956. 20 N222

345. Traulsen, H. THE FRIEDRICH-WILHELM-LUBKE POLDER. (Ge) In Agarsoziale Gesellschaft. LANDLICHE NEUORDNUNG IN SCHLESWIG-HOLSTEIN; BEITRAG ZUR FRUHJAHRSTAGUNG IN KIEL. Gottingen. 9(11): 41-42. June 1960. 281.175 Ag83

346. Tron, M. UTILIZATION OF THE LOWER MEDJERDA VALLEY. (Fr) France. Min. de l'Agr. B. Tech. d'Inform. 1957(116): 47-67. Jan. 1957. 14 F844B

347. Uhden, O. ed. MANUAL OF AGRICULTURAL HYDROLOGY. (Ge) Stuttgart, Franckh'sche Verlagshandlung, 658 pp. 1964. 292 Uh2

348. van Schilfgaarde, J. DRAINAGE RESEARCH OUTSIDE THE UNITED STATES AND CANADA. Drainage Rpt. Comn. ASAE, 25 pp. July 1956.

Drainage research activities outside the United States and Canada were listed. This project was prepared as an extension of the reports by J. R. Davis covering such work in the United States (Summer 1954) and by R. W. Irwin and F. R. Hore for work done in Canada (Dec. 1954).

349. Veen, J. Van. DREDGE, DRAIN, RECLAIM, THE ART OF A NATION. Ed. 4. The Hague, Nijhoff, 200 pp. 1955. 290 V51

The fourth edition of a book was given on the methods used in the Netherlands to dredge, drain, and reclaim land from the sea.

350. Veen, J. Van. DREDGE, DRAIN, RECLAIM: THE ART OF A NATION. Ed. 5. The Hague, Nijhoff, 200 pp. map. 1962. 290 V51

The fifth edition of a book was given on the methods used in the Netherlands to dredge, drain, and reclaim land from the sea.

351. Vilenskii, D. G. THE MESHCHERA VALLEY AND ITS COMPLEX STUDY. (Rus) In Vilenskii, D. G., ed. ISSLEDOVANIE PRIRODNYKH USLOVII SEL'SKOGO KHOZYAISTVA MESHCHERSKOI NIZMENNOSTI. 1: 1-21. map. Ref. 1961. 56.26 V71Is

352. Visser, W. C. THE STATUS OF WATER MANAGEMENT RESEARCH IN CONNECTION WITH FARM WATER MANAGEMENT. (Du) Cent. Organ. v. Toegepast-Natwetensch. Onderz. Verslagen van de Tech. Bijeenkomsten. 13/14: 13-41. 1957/58, pub. 1960. 292.9 C33
Discussion, p. 69-70.

353. Vladychenskii, S. A. PRACTICAL PROBLEMS ON SOIL IMPROVEMENT. (Rus) [Moskva] Izd-vo Moskovskogo Universiteta. 165 pp. 1960. 54 V84

354. Volejnik, M. SOIL IMPROVEMENT HANDBOOK. I. (Cz) Praha, Statni zemedelske nakl., 612 pp. 1962. 54 V88

355. Wagret, P. THE POLDERS. (Fr) Dunod., Paris. 316 pp. maps. Ref. (La Nature et l'Homme. 3) 1959. 54 W12

356. Weinitscnke, H. LAND IMPROVEMENT SCHEME FOR OUR LPG [AGRICULTURAL PRODUCTION COOPERATIVES]. (Ge) Deut. Landwirt. 10(2): 83-88. maps. Feb. 1959. 18 D4822

357. Werff, H. J. Van Der. DRAINAGE OF ENCLOSED LOW PLACES. (Du) Netherlands. Rlandbvoorlichtingsdienst. Landbvoorlichting. 19(5): 226-233. May 1962. 12 N383M

358. Wertheimer, M. PROBLEMS OF DRAINAGE IN THE PALM-GROVES OF SOUTH CONSTANTINOIS. (Fr) Fruits. 12(8): 345-352. Aug./Sept. 1957. 80 F9492

359. Westerhof, J. J. WATER MANAGEMENT PROBLEMS IN DRENTHE. (Du) Nederland. Heidemaatsch. Tijdschr. 66: 300-312. Dec. 1955. 12 N282

360. Wohlenberg, E. SEDIMENT OR SOIL. (Ge) Ber. z. Deut. Landesk. 27(2): 220-228. Sept. 1961. 18 B454

361. Wohni, E. DRAINAGE. (No) Norden. 1956(15): 355-357. Aug. 2, 1956. 11 N754

362. Wolf, W. REMARKS ON THE EFFECT OF DRAINAGE IN EGYPT. (Du) Nederland. Heidemaatsch. Tijdschr. 75(3): 148-153. Mar. 1964. 12 N282

363. Zander, J. SOME ASPECTS OF DRAINAGE. (Du) Wageningen. Inst. v. Landbtech. en Ration. Gestencilde Meded. 1, 65 pp. Ref. 1963. 58.9 W12G

364. Zubets, V. M. PROBLEMS OF EXPLOITATION OF DRAINAGE SYSTEMS. (Rus) Gidrotekh. i Melior. 8(9): 38-45. Sept. 1956. 290.8 G362

SEE ALSO--1, 4, 7, 24, 31, 34, 44, 53, 64, 68, 71, 76-79, 81, 82, 85, 91, 92, 94, 102, 106, 107, 109, 119, 122, 126, 137, 142, 146, 385, 398, 410, 420, 454, 478, 492, 494, 502, 503, 522, 536, 537, 558, 562, 580, 587, 626, 633, 736, 769, 777, 797, 799, 850, 856, 923, 927, 939, 971, 997, 1002, 1004, 1013, 1156, 1191, 1198, 1204, 1214, 1216, 1224, 1228, 1245, 1248, 1250, 1258, 1273, 1275, 1277, 1288, 1300, 1320, 1330, 1335, 1339, 1341, 1351, 1360, 1365, 1368, 1390, 1393, 1394, 1404, 1405, 1408, 1411, 1425, 1427, 1429, 1439, 1450, 1453, 1455, 1461-1464, 1466, 1467, 1471, 1474, 1478, 1490, 1492, 1500, 1502, 1518, 1521-1523, 1533, 1534, 1536, 1541, 1543, 1544, 1546, 1547, 1557, 1562 1565, 1571, 1572, 1576-1578, 1606, 1608, 1619, 1622, 1632, 1641, 1646, 1647, 1653, 1660, 1664, 1677, 1679, 1681, 1684, 1686, 1690, 1697, 1706, 1708, 1711, 1714, 1715, 1720, 1723, 1726, 1729, 1731, 1732, 1734, 1739, 1748, 1753, 1755, 1756, 1758, 1775, 1776, 1779, 1783, 1785, 1789, 1798, 1801, 1807, 1809, 1811, 1817, 1819, 1821, 1825, 1837, 1844, 1845, 1847, 1862, 1869, 1872, 1880, 1882, 1897, 1899, 1907, 1912, 1926, 1936, 1953, 1957, 1972, 1973, 1974, 1980, 2001, 2016, 2025, 2033, 2034, 2040, 2048, 2056, 2062, 2065, 2073, 2078, 2079, 2087, 2088, 2097, 2103, 2107, 2108, 2120, 2138, 2143, 2146, 2148, 2163, 2176, 2179, 2181, 2189, 2210, 2229, 2231, 2249, 2253, 2277, 2278, 2296, 2300, 2308, 2309, 2317, 2326, 2329, 2330, 2349, 2358, 2365, 2378, 2393, 2395, 2406, 2420, 2427, 2445, 2448, 2450, 2478, 2480, 2481, 2498, 2508, 2513, 2523-2525, 2529, 2561, 2583, 2585, 2590, 2592, 2618, 2635, 2641, 2670, 2684, 2755, 2757, 2766, 2772, 2790, 2791, 2795, 2800, 2801, 2809, 2817, 2825, 2841, 2847, 2855, 2873, 2884, 2885, 2887, 2889, 2910, 2912, 2916, 2923, 2933, 2947, 2958, 2968, 2972, 2987, 3031, 3032, 3039, 3058, 3069, 3071, 3082, 3085, 3092, 3119, 3121, 3130, 3159, 3161, 3211, 3212, 3226, 3234, 3247, 3254, 3288, 3290, 3297, 3298, 3310, 3316, 3317, 3331, 3348, 3349, 3356, 3367, 3373, 3378, 3402, 3404, 3406, 3409, 3411, 3420, 3427, 3430, 3431, 3438, 3444, 3450, 3472, 3473, 3474, 3489, 3494, 3502, 3512, 3532, 3540, 3541, 3547, 3562, 3571, 3574, 3577, 3585, 3588, 3593-3595, 3613, 3614, 3621, 3640, 3647, 3655, 3657, 3658, 3664, 3672, 3677, 3682, 3686-3688, 3696, 3699, 3703, 3704, 3706, 3707, 3711, 3712, 3721, 3730, 3738, 3740, 3741, 3744, 3758, 3762, 3766, 3768, 3772, 3778-3780, 3784, 3795, 3797, 3798, 3807, 3808, 3812, 3816, 3819, 3827, 3828, 3835, 3838, 3839, 3841, 3846-3848, 3852, 3854, 3855, 3861, 3862, 3873, 3883, 3886, 3891-3893, 3908, 3909, 3922, 3923, 3926, 3932, 3939, 3941, 3943, 3955, 3957, 3969, 3970, 3976, 3980, 3981, 3986, 3996, 4002, 4005, 4018, 4023, 4026, 4042, 4047, 4048, 4052, 4055, 4061, 4062, 4073-4075, 4083, 4084, 4139, 4153, 4174, 4200, 4256, 4286, 4293, 4358, 4399, 4429, 4469, 4489, 4490, 4533, 4646, 4653, 4660, 4663, 4678, 4695, 4697, 4741, 4742, 4756, 4768, 4809, 4810, 4815, 4830, 4833, 4837, 4839, 4841, 4847, 4857, 4864, 4874, 4887, 4898, 4914-4916, 4918, 4928, 4931, 4937, 4947, 4960, 4966, 4969, 4971, 4975, 4988, 5005, 5007, 5048, 5052, 5058, 5064, 5074, 5096, 5102, 5107, 5119, 5121, 5128, 5129, 5133, 5141, 5142, 5149-5152, 5158, 5160, 5170, 5171, 5183, 5184.

RESEARCH IN RELATED TECHNICAL FIELDS THAT CONCERNS DRAINAGE

Soil Science (Soil Physics, Soil Chemistry, Soil Genesis and Classification and Soil Biology)

365. Abd-El-Samie, A. G., and Marsh, A. W. A TUBE CONTAINING GYPSUM BLOCKS FOR FOLLOWING MOISTURE CHANGES IN UNDISTURBED SOIL. Soil Sci. Soc. Amer. Proc. 19: 404-406. Oct. 1955. 56.9 So3

Gypsum blocks were cast in tubes at 6-inch intervals to measure soil moisture. The tubes were quickly installed in an auger or king tube hole, assuring intimate contact with undisturbed soil and roots.The problems associated with backfill were eliminated and removal at the end of the season was easy. The results indicated that the blocks performed satisfactorily.

366. Afansa'ev, G. V., and Kashanskii, A. D. TO THE PROBLEM OF SOIL SALTINESS AND FORMATION OF SOLONCHAK SOILS IN THE DELTA OF THE NORTHERN DVINA RIVER. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 84: 74-78, 1963. 20 M857.

367. Ahmad, N., and Saleem, M. A REVIEW ON METHODS FOR SOIL MOISTURE ESTIMATION "IN SITU". Pakistan J. Sci. 10(3): 137-142. Ref. May 1958. 475 P172

A review was given on the methods used for soil moisture estimation in the field.

368. Alderfer, R. B. "LOOK-SEE" METHOD ONE OF BEST FOR MEASURING SOIL MOISTURE. N.J. Agr. 38(2): 9-11. Mar./Apr. 1956. 275.28 N46

A report was given on the use of gypsum blocks, and tensiometers for soil moisture measurement in New Jersey.

369. Allison, L. E., and Reeve, R. C. LYSIMETERS FOR STUDYING EFFECTS OF SALINITY, LEACHING, AND POSITION OF WATER TABLE ON PLANT GROWTH. Soil Sci. 79: 81-91. 1955. 56.8 So3

A study was reported on the use of lysimeters to study the effects of salinity, leaching, and height of water table on plant growth.

370. Alpan, I. AN EXPERIMENTAL METHOD FOR DETERMINING THE AIR PERMEABILITY OF PARTLY SATURATED SOILS. Soil Sci. 94(4): 263-269. Oct. 1962. 56.8 So3

The equipment, and experimental procedures were described and analytical tools required for the evaluation of the tests were given for experimetally determining the air permeability of partly saturated soil.

371. Alpat'yev, A. M. ON A COMPLEX METHOD OF DETERMINING SOILS MOISTURE SURPLUS OR DEFICIENCY FOR PLANTS AND ITS USE IN AGRICULTURAL PRACTICE. (Rus) Internatl. Cong. Soil Sci. Rpt. Soviet Soil Sci. 7: 21-26. 1960. 56.09 In847D
English summary.

A report was given on a method used in the U.S.S.R. to determine soil moisture surplus or deficiency for plants to regulate drainage or irrigation systems.

372. American Society for Testing Materials. SYMPOSIUM ON NUCLEAR METHODS FOR MEASURING SOIL DENSITY AND MOISTURE. ASTM Special Tech. Pub. 293, 105 pp. 1961. 56.4 Am3S

The six papers on the design, calibration, and use of Nuclear methods for measuring soil density and moisture presented at the symposium were presented along with the discussion of these papers and a panel discussion on the subjects.

373. Anandakrishnan, M., and Varadarajulu, G. H. LAMINAR AND TURBULENT FLOW OF WATER THROUGH SAND. J. Soil Mechanics and Found. Div., ASCE 89(SM 5): 1-15. Sept. 1963. 290.9 Am3Ps

The flow of water through sands during turbulence was represented by $v^n = k'i$ in which v is the velocity of flow; i the hydraulic gradient; k', a coefficient of turbulence; and n, a turbulence exponent. Values of n and k' were obtained from a plot of constant head permeability tests on four sands, shown as log-log plot of velocity versus hydraulic gradient. For truly laminar flow, n equaled 1. For sands with $d_{10} > 0.03$ cm., the value of n was greater than 1, indicating turbulent flow. The value of n varied with grain size and hydraulic gradient. A plot of Reynold's number versus Friction Factor showed turbulent flow in one case of sand ($d_{10} = 0.03$ cm.) with Reynold's number substantially less than 1. A method was shown for conducting variable head tests for turbulent flow. The quantity of seepage through sand during turbulent flow can be calculated using the appropriate values of k' and n determined in the laboratory by the procedures outlined.

374. Anderson, W. E. "SOIL SANDWICHES"—THEY PREDICT RANGE FEED. Ariz. Stockman. 22(4): 13, 22-23. Apr. 1956. 49 Ar4

A report was given on soil moisture testing equipment used by the Soil Conservation Service in Arizona to forecast range carrying capacity by testing the moisture in the soil in the spring.

375. Andreev, O. B. MEASURING THE SOIL MOISTURE WITH GAMMA RAYS. (Rus) Zemledelie. 1961(1): 59-60. Jan. 1961. 20 Z44

376. Andreev, S. V., and Martens, B. K. SOIL MOISTURE DETERMINATION BY THE METHOD OF NUCLEAR MAGNETIC RESONANCE. (Rus) Pochvovedenie. 1960(10): 112-115. Ref. Oct. 1960. 57.8 P34
English translation—Soviet Soil Sci. 10: 1129-1133. Ref. Oct. 1960. 57.8 P34Ae

A report was given on the use of nuclear magnetic resonance to determine free moisture content of soils in the laboratory.

377. Andrieux, C., Buscarlet, L., Guitton, J., and Merite, B. DEPTH MEASUREMENT OF THE WATER CONTENT OF SOILS BY MODERATION OF FAST NEUTRONS. (Fr) Symposium Use Radioisotopes Soil-Plant Nutr. Studies Proc. 1962: 187-219. Ref. 1962. 387.1 Sy65
English summary.

A prototype neutron device suitable for mass production in France was described and illustrated.

378 Andrushchenko, G. A. ON THE GENESIS AND FEATURES OF PEATS AND OF MUDDY DEPOSITS ON THEM IN DIFFERENT SOIL ZONES IN THE WESTERN REGIONS OF UKRAINE. (Rus) Ukraine. Komis. po Prob. "Ispol'zovanie Mestnykh Istochnikov Udobr. USSR." Mestnye Org. Udobr. Ukrain. SSR. Sborn. 2: 102-122. Ref. 1957. 57.2 Uk7

379. Anma, M., Oda, K., and Kibe, T. STUDY ON SOIL MOISTURE MEASUREMENT BY ELECTRICAL RESISTANCE METHOD. I. (Ja) Kanto-Tosan Agr. Expt. Sta. J. 9: 83-96. Ref. Sept. 1956. 107.6 K83
English summary.

The experimental results in Japan about the practical application of the electrical resistance methods of measuring soil moisture were reported. A Bonyoucos moisture meter was used and calibrated to measure the block resistance of gypsum blocks.

380. Anma, M., Shikata, S. I., Mukai, M., and Gokan, M. ON THE RELATION BETWEEN CLASSIFICATION OF WETNESS OF SOIL SURFACE DURING WINTER CROP SEASON AND ANNUAL VARIATION OF GROUND WATER TABLE IN PADDY FIELD. (Ja) Kanto-Tosan Agr. Expt. Sta. J. 18: 66-93. maps. Ref. Mar. 1961. 107.6 K83
English summary.

Paddy fields in Japan were classified as to the wetness of the soil surface during the winter cover crop season. This classification showed a definite need of drainage of wet areas to increase growth and yield of wheat and barley cover crops.

381. Antipov-Karataev, I. N. PHYSICO-CHEMICAL RESEARCH ON RECLAMATION OF SOLONETZ SOILS. (Rus) (Condensed.) Vest. Sel'skokhoz. Nauki. 1959(12): 11-20. Ref. Dec. 1959. 20 V633
English summary.

A report was given on some physical and chemical research on the reclamation of Solonetz soil in USSR. An agrobiological method was given for the improvement of solonetz soil that has given good results, especially when combined with irrigation.

382. Antipov-Karataev, J. N. THE ALKALI (SZIK) SOILS OF HUNGARY AND THEIR MELIORATION. (Rus) Acta. Agron. (Budapest) 10(3/4): 293-338. Ref. 1960. 19 Ac8
English summary.

A report was given on alkali soil in Hungary and their improvement by leaching, draining, lime, and gypsum.

383. Apostol, I., and Oncescu, M. ON THE METROLOGICAL PARAMETERS IN THE MEASUREMENT OF MOISTURE. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 225-230. Ref. 1965. 291.9 In82

The metrological characterization was given of moisture measuring equipment in situ by the neutron scattering method in Rumania. A method was suggested for determining the threshold of sensitivity and the precision of such equipment.

384. Armstrong, W. W. CONDITIONS AFFECTING SALT ACCUMULATION IN COACHELLA VALLEY DATE GARDENS. Date Growers' Inst. Rpt. 37: 18-22. maps. 1960. 81 D26

Observations were reported from a survey conducted to determine the salinity status of representative date gardens in the Coachella Valley of California.

385. Asghar, A. G., and Hamid, A. IMPORTANCE OF SOIL PROFILE CHARACTERISTICS IN THE RECLAMATION OF SALINE LANDS. Pakistan J. Sci. 7: 35-40. Ref. Jan. 1955. 475 P172

A report was given on the value of studying the soil profile characteristics before reclamating saline soils. An example was given of the variable progress of reclamation of saline soil by the excess irrigation followed by rice growing. The factors found that were causing the difference in reclamation were: pH value; totable soluble salts; clay content; and dry bulk density.

386. Aslyng, H. C., and Kristensen, K. J. WATER BALANCE RECORDER. J. Irrig. and Drain. Div., ASCE 87(IR1, 2762): 15-21. Mar. 1961. 290.9 Am3Ps

A detailed description was given of the design and construction of a semi-floating Lysimeter. The installation consists of two tanks, one inside of the other. Based on change in weight, the change in water level between tanks is amplified and recorded on a clock-driven chart.

387. Aslyng, H. C., and Kristensen, K. J. WATER BALANCE RECORDER. Amer. Soc. Civil Engin. Trans. 127(3): 132-138. 1962. 290.9 Am3

A detailed description was presented of the design and construction of a semifloating lysimeter. The installation consists of two tanks, one inside the other. The inner tank is partly floating and partly counterbalanced. Based on change in weight, the change in water level between tanks is amplified and recorded on a clock-driven chart. Results, based on the use of such a recorder, were presented.

With discussion by Messrs. Lloyd L. Harrold; and Hans C. Aslyng and Knud J. Kristensen. pp. 138-139.

388. Australia Commonwealth Scientific and Industrial Research Organization. PORTABLE SOIL MOISTURE METER. Rur. Res. C.S.I.R.O. 1957(22): 27. Dec. 1957. 23 R88

A report was given on a portable neutron soil moisture meter tested in Australia.

389. Australia Commonwealth Scientific and Industrial Research Organization. THE NEUTRON MOISTURE METER IS HELPING SOIL WATER INVESTIGATIONS. Rur. Res. C.S.I.R.O. 33: 28-29. Sept. 1960. 23 R88

A report was given on the description and use of the neutron moisture meter for soil moisture measurements in Australia.

390. Awada, M. SOIL MOISTURE TENSION IN RELATION TO GROWTH AND YIELD OF PAPAYA (CARICA PAPAYA L.). Hawaii Agr. Expt. Sta. Tech. B. 49, 15 pp. 1962. 100 H313T

Results were given on the following experiments: (1) Papaya plants of the Solo variety grown in the field at Waimanalo, Honolulu, Hawaii, under three soil moisture tension conditions ranging from 0.22 atmosphere to 6.3 atmospheres, during the summer of 1959; and (2) during the summer of 1960, plants were grown under four soil moisture tension levels ranging from 0.27 atmosphere to 7.7 atmospheres. Tensiometers were used for the two "wet" treatments and gypsum blocks for the two "drier" treatments. They were installed at the 18- and 24-inch depth during the experimental periods of 1959 and 1960, respectively.

391. Ayers, H. D. THE EFFECT OF CROP COVER ON THE INFILTRATION CHARACTERISTICS OF GUELPH LOAM SOIL. Canada J. Soil Sci. 37: 128-133. 1957. 56.8 C162

Application of simulated rainfall to a Guelph loam soil indicated that a dense cover crop of grasses and legumes served to maintain the infiltration capacity above 1.6 inches per hour during the first 60 minutes of wet runs. When the cover was removed and the soil surface prepared to simulate finely prepared seedbed the infiltration capacity dropped to 0.7 inches per hour or less after 60 minutes. The mass infiltration of water during the initial runs on plots appeared to be inhibited by air entrapment in the soil profile.

392. Babcock, K. L., and Overstreet, R. THERMODYNAMICS OF SOIL MOISTURE: A NEW APPLICATION. Soil Sci. 80: 257-263. 1955. 56.8 So3

Present basic assumptions involved in applying thermodynamics to soil moisture was examined and a new theory was presented.

393. Babcock, K. L., and Schulz, R. K. EFFECT OF ANIONS ON THE SODIUM-CALCIUM EXCHANGE IN SOILS. Soil Sci. Soc. Amer. Proc. 27: 630-632. 1963. 56.9 So3

Samples of Yolo fine sandy loam were leached with two series of solutions containing Na and Ca in which the composition varied. In each series, the composition of the solutions in the corresponding solutions was the same except that in one series the anion was chloride and in the other it was sulfate. After leaching the samples to equilibrium, the echangeable sodium was higher for the sulfate series than for the chloride series. This was attributed to the effect of the different activity coefficients of the salts used.

394. Ballantyne, A. K., and Clayton, J. S. THE RELATIONSHIP OF EXCHANGEABLE CATIONS IN THE B HORIZONS TO THE FIELD DEPARATIONS OF SOLONETZIC AND CHERNOZEMIC SOILS. Canad. J. Soil Sci. 44(1): 43-49. 1964. 56.8 C162

Exchangeable cation data were presented for 97 Solonetzic and 131 Chernozemic B horizons from profiles sampled on morphological characteristics, by the Saskatchewan Soil Survey. The average exchangeable sodium percentage in the B horizons of the Calcareous, Orthic, and Eluviated Chernozems was 0.95, 1.3, and 2.6; and in the B_n horizons of the Solonetz, Solodized Solonetz, and Solod was 4.5, 9.4, and 4.0.

395. Banks, C. H. POTENTIAL VAPOUR LOSSES FROM A SOIL-FILLED LYSIMETER WITH NATURAL SCRUB COVER, AS AFFECTED BY HERBICIDES AND BURNING. Forestry So. Africa. 4: 37-51. Apr. 1964. 99.8 B652

A report was given of the evapotranspiration from a lysimeter experiment in South Africa in which herbicides and burning were used to control natural scrub cover.

396. Barnes, O. K., and Costel, G. A MOBILE INFILTROMETER. Agron. J. 49(2): 105-107. Feb. 1957. 4 Am34P

A mobile infiltrometer used for determining water intake rates of soils was described and illustrated.

397. Bartelli, L. J., and Peters, D. B. INTEGRATING SOIL MOISTURE CHARACTERISTICS WITH CLASSIFICATION UNITS OF SOME ILLINOIS SOILS. Soil Sci. Soc. Amer. Proc. 23: 149-151. 1959. 56.9 So3

Soil moisture characteristics (15 atm., 1/3 atm., etc.) were determined for 31 soil types representing the major great soil groups recognized in Illinois. In addition such physical properties as bulk density and mechanical analysis were also determined for the principal soil horizons. Available soil moisture and field capacity was shown to vary by textural classes for each soil group studied. For example it was found that silt loam soils of the Gray-Brown Podzolic averaged more available moisture in the A horizon than the Brunizems and Planosols. It was found that the available soil moisture was highly correlated with the 1/3-atm. percentage but not correlated with the 15-atm. percentage. The available moisture was controlled principally by the silt fraction.

398. Baver, L. D. SOIL PHYSICS. Ed. 3. John Wiley & Sons, Inc., N.Y. 489 pp. 1956. 56.43 B32

A textbook was given that was written primarily for advanced undergraduate and graduate students. Several chapters were related to drainage and one chapter was devoted to the principles of soil drainage.

399. Beauchamp, E., and Steppler, H. A. NOTE ON A METHOD OF STUDYING SUBSOILS IN THE GREENHOUSE BY MEANS OF A LYSIMETER. Canad. J. Soil Sci. 43(2): 405-407. Aug. 1963. 56.8 C162

A method used in Canada for studying subsoils in the greenhouse by means of a lysimeter was described.

400. Beer, E. E. De, and Goelen, E. H. G. MEASUREMENT OF MOISTURE CONTENT OF SOIL BY RADIOISOTOPES. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 213-223. 1965. 291.9 In82

A report was given on the examination of the problem of the continuous determination in Belgium of the variation of the volumetric water content with depth by means of a neutron probe.

401. Beers, W. F. J. Van. THE AUGER-HOLE METHOD; A FIELD MEASUREMENT OF THE HYDRAULIC CONDUCTIVITY OF SOIL BELOW THE WATER TABLE. Internatl. Inst. Land Reclam. and Impr. B.1, 32 pp. Ref. 1958. 54.9 In83B

The auger-hole method is a rapid, simple, and reliable method for measuring hydraulic conductivity of soil below a water table. It is mostly used with the design of drainage systems in waterlogged land and in seepage investigations.

Details of the method were given as it is used in the Netherlands.

402. Behnke, J. J., and Schiff, L. HYDRAULIC CONDUCTIVITY OF UNIFORM, STRATIFIED, AND MIXED SANDS. J. Geophysical Res. 68: 4769-4775. 1963. 470 J823

Hydraulic conductivities and velocities for the lower limits of very coarse, coarse, medium and fine sands (U.S.D.A. classification) were determined from a model study using transparent plastic cylinders.

In uniform sands, the velocity under 1.0 ft. of surface head ranged from 43 to 2118 ft./day and the hydraulic conductivity ranged from 19 to 970 ft./day for the fine and very coarse sands, respectively. Velocity values in four successive stratified layers of equal thickness were essentially equal in magnitude and closest to those determined for the uniform, fine sand. The velocity in a stratified medium composed of a "limiting layer" of medium sand placed between two layers of very coarse sand was 10.4 percent of the velocity calculated for an equivalent thickness of the coarse sand alone. Hydraulic conductivity and velocity values in a mixture composed of 25 percent of each of the four sizes were nearly identical to the values determined from a uniform, fine sand. The velocity in a binary mixture composed of 65 percent very coarse and 35 percent fine was only 9.3 percent greater than the velocity for the fine sand alone. Values for other binary mixtures were included.

403. Belikov, M. P., Emel'yanov, V. A., and Nesterou, V. E. USE OF RADIOACTIVE ISOTOPES IN HYDRO ENGINEERING. (OTS 64-11112) 290 B416Ae
Translation of Primenenie Radioaktivnykh Izotopov v Gidrotekhnicheskom Stroitel'stve.

A report was given in this Russian translation, on the use of radioactive isotopes in hydro engineering. The use of neuclear-radiation measurement, gamma radiation, neutron methods, and radioactive tracers were discussed.

404. Benini, G. PREMISES FOR THE CONSTRUCTION OF A LYSIMETRIC STATION OF PADUA. (It) Agr. delle Venezie. 17(7/8): 410-423. Ref. July/Aug. 1963. 16 Ag826

405. Benz, L. C., Mickelson, R. H., Jensen, M. E., and Sandoval, F. M. SMALL AND LARGE-DIAMETER, WATER-TABLE OBSERVATION WELLS COMPARED. Trans. ASAE 6(2): 93-94, 97. 1963. 290.9 Am32T

The comparative sensitivity and costs of 3/8 and 4-in. diameter shallow observation wells were elevated. Small wells in fine-textured soils gave a better estimate of the water table and were more responsive to influences causing fluctuations. The small well was also more economical to install.

Both large and small diameter wells had their own peculiar advantages and disadvantages, depending on the primary purpose of the well. Large diameter wells permitted collection of large water samples with relative ease and also provided the opportunity to collect large soil samples for visual and/or laboratory analysis.

Observation wells should not extend below the lowest expected elevation of the water table to minimize the influence of artesian pressures.

406. Berg, L. G., and Sitnikov, N. V. RAPID DETERMINATION OF SOIL MOISTURE BY THE HYDRIDE METHOD. (Rus) Pochvovedenie. 1958(5): 78-80. Ref. May 1958. 57.8 P34
English Translation—Soviet Soil Sci. 5: 78-80. Ref. May 1958. 57.8 P34Ae

A report was given on the use of the hydride method for a fast determination of soil moisture.

407. Bertoni, J., Larson, W. E., and Shrader, W. D. DETERMINATION OF INFILTRATION RATES ON MARSHALL SILT LOAM FROM RUNOFF AND RAINFALL RECORDS. Soil Sci. Soc. Amer. Proc. 22(6): 571-574. Nov./Dec. 1958. 56.9 So3

A report was given on the determination of infiltration rates of soil from runoff and rainfall records.

408. Besednov, N. A. IN REGARD TO ANALYZING THE WATER AND PHYSICAL PROPERTIES OF SOILS AND GROUNDS FOR PURPOSES OF RECLAMATION OF SALINE SOILS. (Rus) Pochvovedenie. 7: 93-95, July 1955. 57.8 P34

409. Bethlahmy, N., and Zwerman, P. J. THE USE OF ELECTRICAL RESISTIVITY APPARATUS IN SOIL INVESTIGATIONS. Trans. ASAE 2(1): 68-70. Ref. 1959. 290.9 Am32T

A report was given on the use of electrical resistivity aparatus to measure soil depths to bedrock and other tests. A hypothesis was given concerning the water movement in the Mardin-Volusin soils in New York.

410. Betremieux, R., and Gobillot, T. PEDOLOGY AND DRAINAGE PROBLEMS. (Fr) Acad. d'Agr. de France. Compt. Rend. 47(9): 490-493. 1961. 14 P215Bc

411. Bettenay, E., Blackmore, A. V., and Hingston, F. J. ASPECTS OF THE HYDROLOGIC CYCLE AND RELATED SALINITY IN THE BELKA VALLEY, WESTERN AUSTRALIA. Austral. J. Soil Res. 2(2): 187-210. map. Ref. Dec. 1964. 56.8 Au7

The factors involved in increased salinity, that have followed land clearing in Western Australia, were investigated. Salinity was associated with a three-component hydrological system involving surface, soil, and aquifer waters. The amount of surface and soil waters have increased after clearing.

It was concluded that the main part of the salt in the landscape has accumulated through atmospheric accession.

412. Beutel, J. A. GROWER EXPERIENCES WITH TENSIOMETERS. Calif. Citrog. 47(8): 271, 290-293. June 1962. 80 C125

A report was given on some growers experience with tensiometers in California citrus orchards.

413. Bianchi, W. C. MEASURING SOIL MOISTURE TENSION CHANGES. Agr. Engin. 43(7): 398-399, 404. July 1962. 58.8 Ag83

A device that transforms a change in the apparent negative pressure exhibited by soil moisture (soil moisture tension) into an electrical resistance change was described and illustrated. A number of these pressure-induced resistance changes can be transmitted by lead wires from cells at remote points and deep soil depths back to a central data-recording location where they can be scanned periodically or continuously recorded on commercially available equipment.

414. Bianchi, W. C., and Haskell, E. E., Jr. A STRAIN GAGE PRESSURE CELL FOR RAPID DETERMINATION OF HYDRAULIC CONDUCTIVITY OF SOIL CORES. Amer. Soc. for Testing and Materials Proc. 63: 1227-1234. 1963. 290.9 Am3Ps

This cell is basically a falling head permeameter where a very small volume of water is displaced through the core as a pressure-stressed metal diaphragm relaxes. The volume displacement of the diaphragm is a linear function of applied head. Head is calibrated against the output of two strain gages applied to the surface of the diaphragm. Recording strain gage output with time on a strip chart recorder or direct reading bridge gives an accurate measurement of the time-head function needed to evaluate the conductivity from the falling head formula.

415. Bianchi, W. C., and Haskell, E. E., Jr. FIELD MEASUREMENT OF SOIL WATER MOVEMENT DURING ARTIFICIAL GROUND-WATER RECHARGE. Trans. ASAE 7(3): 341-343. 1964. 290.9 Am32T

A report was given on the field measurement of soil moisture content by nuclear scattering methods and wet density coupled with piezometers for measuring soil moisture movement during artificial ground water recharge.

416. Bianchi, W. C., and Tovey, R. METHOD OF OBTAINING CONTINUOUS MEASUREMENTS OF PIEZOMETRIC HEADS IN SHALLOW ARTESIAN AQUIFERS. Agr. Engin. 41(8): 516-517. Aug. 1960. 58.8 Ag83

A method to obtain continuous measurements of piezometric heads was proposed that separates the water-table from the artesian aquifer effects by achieving a water seal between the two.

417. Bierhuizen, J. F. SOME OBSERVATIONS ON THE RELATION BETWEEN TRANSPIRATION AND SOIL MOISTURE. Netherlands J. Agr. Sci. 6(2): 94-98. Ref. May 1958. 12 N3892

The relation between transpiration and soil moisture was studied in pot experiments in the greenhouse using kidney beans (Phaseolus vulgaris) as a test crop.

418. Biggar, J. W. ON THE KINETICS OF MOISTURE FLOW IN UNSATURATED SOILS. (Abs.) Utah Agr. Col. Monog. Ser. 4(4): 13. June 1956. 276 Ut15M

An abstract was given on a doctors thesis on the kinetics of moisture flow in unsaturated soils. The movement of water into an air dry silt loam soil was modified by free energy barriers existing in the soil water system.

419. Birkman, Z. M., and Druvietis, R. I. PEAT SUPPLIES OF LATVIAN SSR. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 108-128. Ref. 1957. 56.33 R922

420. Bitiukov, K. K., Mikhailov, M. N., and Popova, V. L. ACCUMULATION AND PRESERVATION OF MOISTURE IN THE SOIL. Ed. 2. rev. and enl. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhozfaistvennoi Literatury. 173 pp. 1956. 56.43 B54

421. Bitner, K. THE PEAT BOG OF BAGNOWO. (Pol) Przegl. Geog. 32(4): 487-513. maps. 1960. 278.8 P95
English summary.

A discussion was given of the genesis and classification of the peat bog of Bognowo.

422. Black, J. D. F. NEUTRON-SCATTER MOISTURE METER AT SCORESBY. Victorian Hort. Digest 8(2): 21-22. Winter 1964. 80 V662

A report was given on the use of the neutron scattering moisture meter in Australia.

423. Bloemen, G. W. HYDRAULIC DEVICE FOR WEIGHING LARGE LYSIMETERS. Trans. ASAE 7(3): 297-299. 1964. 290.9 Am 32T

Weighing equipment was described and illustrated for weighing large lysimeters.

424. Bloodworth, M. E., and Page, J. B. USE OF THERMISTORS FOR THE MEASUREMENT OF SOIL MOISTURE AND TEMPERATURE. Soil Sci. Soc. Amer. Proc. 21(1): 11-15. Ref. Jan./Feb. 1957. 56.9 So3

The thermal method of soil moisture measurements covers the, available moisture range, with its greatest sensitivity near and below field capacity. The thermal units have been unaffected by salt concentrations normally found in agricultural soils.

425. Boelter, D. H. WATER STORAGE CHARACTERISTICS OF SEVERAL PEATS _IN SITU_. Soil Sci. Soc. Amer. Proc. 28(3): 433-435. 1964. 56.9 So3

Water storage characteristics of the various horizons in a northern Minnesota bog were found to vary considerably with peat type. Surface horizons of sphagnum moss peat contain 0.020 g. per cc. of dry material and 95 to nearly 100 percent water by volume at saturation. Its total porosity consisted primarily of large pores which released 0.80 cc. of water per cc. between saturation and 0.1 bar suction.

Decomposed and herbaceous peats from horizons below 25 cm. had water-holding properties strikingly different from those of the moss peats. These materials had bulk densities of 0.24 and 0.14 g. per cc., respectively, and they contained between 80 and 90 percent water by volume at saturation. Their porosity, though high, consisted primarily of many small pores which are not easily drained at low suctions. They retained 65 to 75 percent water by volume at 0.1-bar suction.

426. Boelter, D. H. LABORATORY TECHNIQUES FOR MEASURING WATER STORAGE PROPERTIES OF ORGANIC SOILS. Soil Sci. Soc. Amer. Proc. 28(6): 823-824. Nov./Dec. 1964. 56.9 So3

Laboratory techniques were described for measuring water storage properties of organic soils (sphagnum moss peat and herbaceous peat).

Undried and undisturbed samples best represented the conditions of peat in the field and gave the most accurate estimates of its water retention characteristics.

427. Bolt, G. H. THE DETERMINATION OF MOISTURE CONTENT AND SPECIFIC GRAVITY OF SOILS WITH THE HELP OF NEUTRONS AND GAMMA RAYS. (Du) Landbk. Tijdschr. 70(extra no.): 282-286. May 1958. 105.2 Or3

428. Bolt, G. H., and Miller, R. D. CALCULATION OF TOTAL AND COMPONENT POTENTIALS OF WATER IN SOIL. Amer. Geophys. Union. Trans. 39(5): 917-928. Ref. Oct. 1958. 330.9 Am3

Calculations were given on the total and component potentials of water in soil

429. Bondurant, J. A. DEVELOPING A FURROW INFILTROMETER. Agr. Engin. 38: 602-604. 1957. 58.8 Ag83

The furrow infiltrometer was tested by comparing the infiltrometer data with infiltration data obtained from field irrigation trials by using inflow-outflow measurements. Field measurements were made on four-row plots which included two furrows in which the infiltrometers were placed. The objective was to obtain a better measure of the infiltration rate of irrigated furrows than has been possible with previous infiltrometers.

This infiltrometer provides a means of measuring furrow infiltration rates when field measurements by irrigation trial are not feasible.

430. Bonfils, P., Charreau, C., and Mara. LYSIMETER STUDIES IN SENEGAL. (Fr) Agron. Trop. [Paris] 17(10): 881-914. map. Oct. 1962. 26 Ag86
English summary.

A report was given of lysimeter studies in Senegal.

431. Bonnet, J. A., and Brenes, E. J. SALINITY PROBLEMS ON HEAVY CALCAREOUS CLAYS OF SOUTHWESTERN ARID PUERTO RICO. Cong. Internatl. de la Sci. da Sol Rpt. 6(D, comn., VI): 515-524. 1956. 56.09 In8452

A report was given on a salinity survey in southwestern Puerto Rico.

432. Boodt, M. De, Leenheer, L. De, and Mortier, P. THE RESOLVING POWER OF THE NEUTRON SCATTERING METHOD FOR SOIL MOISTURE DETERMINATION. Pedologie 11(spec. no.): 119-125. 1961. 56.8 P34

Experimental work in the Netherlands was reported on improving the resolving power of the neutron scattering method for soil moisture measurement.

433. Booy, A. H. RECLAIMED PEAT MOOR SOILS OF DRENTE. UNIFORM SOILS? (Du) Boor en Spade 10: 97-105. maps. 1959. 56.9 B64
English summary.

A report was given on the reclaimed peat moor soils of Drente, Netherlands. They are not uniform soils except that they have firm peat and "greasy" layers.

434. Bornstein, J., and Alberts, R. R. TRANISTORIZED PIEZOMETER WATER LEVEL READER. J. Agr. Engin. Res. 8(4): 340-341. 1963. 58.8 J82

A transistorized piezometer water level reader used in England for measuring ground water pressure was described and illustrated.

435. Borovinskaya, L. B. STUDY OF TRANSMISSION OF WATERS OF THE VOLGA-DON CANAL BY MEASUREMENT OF NATURAL ELECTRIC FIELD POTENTIALS. (Rus) Pochvovedenie. 5: 69-72. May 1964. 57.8 P34
English translation—Soviet Soil Sci. 5: 502-505. May 1964. 57.8 P34Ae

A report was given on the measurement of canal water and underground water in the Volga-Don Canal in the U.S.S.R. by the measurement of natural electric field potentials.

436. Borowiec, S., and Kwarta, C. COMPARISON OF DIRECT AND INDIRECT METHODS OF SOIL MOISTURE DETERMINATION IN PERMANENT GRASSLAND. (Pol) Rocz. Gleboznawcze 10(sup.): 631-633. 1961. 56.8 R592

437. Botha, A. D. P. APPARATUS FOR DETERMINING THE SPEED OF WATER INFILTRATION IN SOILS. (Af) So. African J. Agr. Sci. 2(2): 261-264. June 1959. 24 Su3

438. Bouwer, H. A DOUBLE TUBE METHOD FOR MEASURING HYDRAULIC CONDUCTIVITY OF SOIL IN SITU ABOVE A WATER TABLE. Soil Sci. Soc. Amer. Proc. 25(5): 334-339. Sept./Oct. 1961. 56.9 So3

A method for measuring hydraulic conductivity of soil in situ above a water table was proposed. The method consists essentially of saturating a limited soil region below an auger hole in which two concentric tubes are placed. The method was illustrated with an example.

439. Bouwer, H. FIELD DETERMINATION OF HYDRAULIC CONDUCTIVITY ABOVE A WATER TABLE WITH THE DOUBLE-TUBE METHOD. Soil Sci. Soc. Amer. Proc. 26(4): 330-335. July/Aug. 1962. 56.9 So3

Theory and principle of the double tube method of hydraulic conductivity were applied and tested in laboratory and field studies. Field equipment and procedures for practical application of the double-tube method were discussed in detail.

440. Bouwer, H. THEORETICAL EFFECT OF UNEQUAL WATER LEVELS ON THE INFILTRATION RATE DETERMINED WITH BUFFERED CYLINDER INFILTROMETERS. J. Hydrol. 1(1): 29-34. Mar. 1963. 292.8 J82

Differences in water level between cylinder and buffer of a buffered infiltrometer installation caused the infiltration rate as calculated from outflow from the inner cylinder to be in error. The author determined the error in relation to the water level difference between cylinder and buffer, the diameter and depth of installation of the cylinder, and the final hydraulic gradient.

441. Bouwer, H. IN-PLACE MEASUREMENT OF SOIL HYDRAULIC CONDUCTIVITY IN THE ABSENCE OF A WATER TABLE. Internatl. Soc. Soil Mech. and Found. Engin. Proc. 2(1): 130-133. May 1963.

With the double-tube method, hydraulic conductivity, $\underline{k}$, of soil in situ is determined, in the absence of a water table, from the flow between two concentric tubes in an auger hole. The flow, which takes place in an artificially saturated soil region below the auger hole, is caused by creating water-level differences in the tubes. Dimensionless factors, which describe the geometry of the flow system and which were evaluated with an electrical resistance network analog, were used in the calculation of $\underline{k}$. It was shown how a time consuming graphical integration for solving the equation for $\underline{k}$ can be replaced by a simple arithmetic procedure.

442. Bouwer, H. MEASURING HORIZONTAL AND VERTICAL HYDRAULIC CONDUCTIVITY OF SOIL WITH THE DOUBLE-TUBE METHOD. Soil Sci. Soc. Amer. Proc. 28(1): 19-23. Jan./Feb. 1964. 56.9 So3

Horizontal and vertical hydraulic conductivity, symbols K_h and K_v, respectively, of anisotropic soils in which the principal conductivity components are in the horizontal and vertical directions, can be measured with the double-tube method. The principle was based on manipulation of flow direction in the artificially saturated soil region below the auger hole. As with the original double-tube method, the presence of a water table is not required.

443. Bouwer, H., and Rice, R. C. SIMPLIFIED PROCEDURE FOR CALCULATION OF HYDRAULIC CONDUCTIVITY WITH THE DOUBLE-TUBE METHOD. Soil Sci. Soc. Amer. Proc. 28(1): 133-134. Jan./Feb. 1964. 56.9 So3

A simplified procedure was presented for the calculation of hydraulic conductivity with the double-tube method.

444. Bouwer, H., Zwerman, P. J., Gray, H. E., and Levine, G. DRAINAGE RESEARCH METHODS ON STONY SOILS. Agr. Engin. 36: 591-592, 594. 1955. 58.8 Ag83

Techniques were presented for measuring water-table elevations and ground-water pressures in stony soils. The selection of the auger-hole method as a suitable method for measuring soil permeability in situ for these soil conditions were discussed, and the technique for installing auger holes and for obtaining and processing the necessary field observations were presented.

445. Bouyoucos, G. J. ELECTRICAL RESISTANCE METHODS AS FINALLY PERFECTED FOR MAKING CONTINUOUS MEASUREMENT OF SOIL MOISTURE CONTENT UNDER FIELD CONDITIONS. Cong. Internatl. de Bot. Rap. et Commun. 8(sect. 11/12): 203-207. 1954. 451 In833

A report was given on the plaster of paris and the nylon electrical resistance methods of soil moisture measurements devised at the Michigan Agricultural Experiment Station. The two methods supplement each other as one covers the higher levels of water content and the other the lower levels.

446. Bouyoucos, G. J. IMPROVED SOIL MOISTURE METER. Agr. Engin. 37: 261-262. Apr. 1956. 58.8 Ag83

Changes and improvements made in a moisture meter used in connection with plaster-of-paris-blocks to measure soil moisture, especially for irrigation purposes, were given.

447. Bouyoucos, G. J. MEASURING SOIL MOISTURE TENSION. Agr. Engin. 41(1): 40-41. Jan. 1960. 58.8 Ag83

A new calibration was presented on the plaster of paris electrical-resistance block method for measuring soil moisture under field conditions.

448. Bouyoucos, G. J. SOIL MOISTURE MEASUREMENT IMPROVED: NEW PLASTER OF PARIS BLOCKS PROVE MORE ACCURATE AND SENSITIVE. Agr. Engin. 42(3): 136-138. Ref. Mar. 1961. 58.8 Ag83

A report was given on new plaster of paris blocks that have proved more accurate and sensitive than the old style for soil moisture measurement.

449. Bouyoucos, G. J. A CONTINUOUS ELECTRIC SOIL MOISTURE RECORDER. Agron. J. 54(6): 549. Nov./Dec. 1962. 4 Am34P

An electric recorder that makes a continuous record of the moisture in the soil, using the new sensitive plaster of paris block was described and illustrated. The recorder is battery operated.

450. Bouyoucos, G. J. CYLINDRICAL VERSUS RECTANGULAR PLASTER OF PARIS BLOCKS FOR MEASURING SOIL MOISTURE. Agron. J. 56(1): 92-93. Jan./Feb. 1964. 4 Am34P

A discussion was given of the advantages and disadvantages of the cylindrical and rectangular plaster of paris blocks for measuring soil moisture. It was concluded that the rectangular block, as currently made, possesses all of the advantages of the coaxial type of block, and none of its disadvantages.

451. Bouyoucos, G. J. PLASTER OF PARIS BLOCK ELECTRIC MEASURING UNIT FOR MAKING A CONTINUOUS MEASUREMENT OF SOIL MOISTURE UNDER FIELD CONDITIONS. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 105-111. Ref. 1965. 291.9 In82

A report was given on the principles and use of the plaster of paris block measuring unit for measuring soil moisture under field conditions.

452. Bower, C. A. SODIUM ELECTRODE AND ITS USE FOR SALINITY INVESTIGATIONS. Internatl. Cong. Soil Sci. Trans. 7(II): 16-21. 1960. 56.09 In847T

A glass electrode which responds selectively to Na^+ in nonacid solutions is now available. The Na concentration of water, soil-water extracts and Mg acetate extracts of soils can be measured potentiometrically by the glass electrode using a calomel half-cell as the reference electrode. Methods were given for determining soluble and exchangeable Na, and cation exchange capacity by Na-saturation. Sodium determinations by the electrode and flame photometer methods were in good agreement.

453. Bower, C. A. DIAGNOSING SOIL SALINITY. U.S. Dept. Agr., Agr. Inform. B. 279, 11 pp. Dec. 1963. 1 Ag84Ab

The proper management and treatment of salt-affected soils depends upon accurate knowledge of the nature and severity of the problem. The need and use of soil salinity tests were discussed.

454. Bower, C. A., and Fireman, M. SALINE AND ALKALI SOILS. U.S. Dept. Agr. Ybk. Agr. 1957: 282-290. 1957. 1 Ag84Y

Saline and alkali soils in the United States were described. Recommended methods to improve these soils were given.

Adequate drainage is essential for the permanent improvement of saline and alkali soils. Leaching operations and the application of amendments for the replacement of adsorbed sodium will be largely ineffective unless the ground-water table remains deep enought to prevent appreciable upper movement of water.

455. Bower, C. A., and Hatcher, J. T. CHARACTERIZATION OF SALT-AFFECTED SOILS WITH RESPECT TO SODIUM. Soil Sci. 93: 275-280. 1962. 56.8 So3

A discussion was given of the different methods used to determine the ESP of salt affected soils.

456. Bowser, W. E., Milne, R. A., and Cairns, R. R. CHARACTERISTICS OF THE MAJOR SOIL GROUPS IN AN AREA DOMINATED BY SOLONETZIC SOILS. Canad. J. Soil Sci. 42: 165-169. 1962. 56.8 C162

The profiles studied were from an area in which Solonetzic soils and Chernozemic soils were, geographically, closely associated. The chemical and physical characteristics of the Solonetz and Solodized Solonetz profiles clearly distinguished them from the Orthic Chernozemic soils. The B horizon of the Solonetz and Solodized Solonetz soils contained over 15 percent exchangeable sodium and had a pronounced accumulation of illuvial clay. The C horizons were quite saline, the principal salt being sodium sulphate. The geographically associated Orthic Cherozemic soils exhibited none of these characteristics. The A horizons of these Solonetzic soils were more acid than the A horizons of the Orthic Chernozemic soils. The more strongly leached profiles had morphological and chemical characteristics that were intermediate between the above two groups; some were classed as Solods and some as Eluviated Chernozemic soils.

457. Branson, P. L. REVIEW OF LYSIMETER STUDIES TO DATE AND PLANS FOR THE FUTURE. Calif. Fert. Conf. Proc. 4: 23-27. 1956. 57.9 C123

A report was given on past and plans for future lysimeter research at the Citrus Experiment Station, Riverside, Calif.

458. Brill, G. D., and Willits, N. A. BARREL LYSIMETERS FOR MEASURING EVAPOTRANSPIRATION FROM CROPS. Agron. J. 51(1): 59-60. Jan. 1959. 4 Am34P

A simple barrel lysimeter for measuring evapotranspiration from field crops was described and illustrated.

Data from these lysimeters planted to snap beans compared very favorably with those obtained by gravimetric sampling during the 1957 season.

459. Briones, A. A., and Cagauan, B. G. MOISTURE RETENTION OF SOME PADDY SOILS IN LAGUNA. Philippine Agr. 48(2/3): 61-81. July/Aug. 1964. 25 P542

A report was given on the amount of available water retained in eight Laguna paddy soils. This amount generally increased with increasing clay content as indicated by a correlation coefficient, $r = 0.340$, found significant at the 5 percent level.

460. Brooks, R. H., and Reeve, R. C. MEASURMENT OF AIR AND WATER PEREABILITY OF SOILS. Trans. ASAE 2: 125-126, 128. 1959. 290.9 Am32T

Methods of measuring both air and water permeability of soils in the laboratory were reviewed. The various factors which affect measurement were discussed and the use that can be made of these combined measurements was given.

461. Brown, D. A. CHARACTERIZING ARKANSAS SOILS. Ark. Farm. Res. 7(3): 8. May/June 1958. 100 Ar42F

A report was given on the classification of soils in Arkansas of drainage and other characteristics for better recommendations in soil fertility, tillage, crop adaptation, and soil conservation.

462. Bruce, R. R., and Klute, A. THE MEASUREMENT OF SOIL MOISTURE DIFFUSIVITY. Soil Sci. Soc. Amer. Proc. 20: 458-462. Oct. 1956. 56.9 So3

A report was given on one of the methods of measuring soil moisture diffusivity.

463. Bruce, R. R., and Klute, A. MEASUREMENTS OF SOIL MOISTURE DIFFUSIVITY FROM TENSION PLATE OUTFLOW DATA. Soil Sci. Soc. Amer. Proc. 27(1): 18-21. Jan./Feb. 1963. 56.9 So3

A tension plate apparatus designed for measuring volume of water outflow from samples of porous material as a function of time was described and illustrated. Volume outflow was measured from samples of glass beads and sands at moisture tensions < 200 cm. of water.

464. Bucur, N., Gafencu, A., and Merlescu, E. CONTRIBUTIONS TO THE STUDY OF WATER ABSORPTION IN SALINE SOILS. (Rum) Jassy. Inst. Agron. "Ion Ionescu de la Brad." Lucrari Sti. 1961: 95-104. 1961. 106.4 J31L
French summary.

465. Bulgakov, N. P. MARSHY SOILS OF BELORUSSIA SSR. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHEMYKH POCHV, 1955. Trudy, pp. 251-273. Minsk. 1956. 54.9 K83

466. Burgy, R. H., and Luthin, J. N. A TEST OF THE SINGLE- AND DOUBLE-RING TYPES OF INFILTROMETERS. Amer. Geophysical Union Trans. 37: 189-192. 1956. 330.9 Am3

The results of field experiments with ring-type infiltrometers were reported. Infiltration rates obtained with the rings were compared to the infiltration rates obtained by flooding the entire area to determine the number of ring measurements required to characterize the infiltration rate of the area. It was found on a uniform soil profile having no layers restricting the downwared movement of water that six infiltrometers gave an average figure that was within 30 percent of the true mean. The single-ring infiltrometers were compared with the double-ring infiltrometers. There was no significant difference in the results obtained with the two types of infiltrometers on a uniform soil under the conditions of the tests.

467. Burke, H. D., and Krumbach, A. W., Jr. NITROGEN PROBE FOR SOIL MOISTURE SAMPLING. J. Geophysical Res. 64(8): 1039-1042. Aug. 1959. 470 J823

Moisture determinations were made on soil cores frozen to hollow probes into which liquid nitrogen had been poured. Values compared closely with those from samples extracted by more conventional methods.

468. Burn, K. N. CALIBRATION OF A NEUTRON SOIL MOISTURE METER. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 205-211. 1965. 291.9 In82

A report was given on the calibration of a neutron soil moisture meter in Canada.

469. Burns, G. R., and Dean, L. A. THE MOVEMENT OF WATER AND NITRATE AROUND BANDS OF SODIUM NITRATE IN SOILS AND GLASS BEADS. Soil Sci. Soc. Amer. Proc. 28(4): 470-474. July/Aug. 1964. 56.9 So3

The movement of water and nitrate around bands of $NaNO_3$ was studied in soils and glass beads in the laboratory. A hypothesis was developed and tested concerning the predominately downward movement of NO_3^- from a band of $NaNO_3$ in soils with moisture contents greater than field capacity.

470. Burrows, W. C., and Kirkham, D. MEASUREMENT OF FIELD CAPACITY WITH A NEUTRON METER. Soil Sci. Soc. Amer. Proc. 22(2): 103-105. Mar./Apr. 1958. 56.9 So3

The moisture vs. time curve was carried out at 6 inch increments to a depth of 5 feet on four soils. Plots of soil were soaked with water and a soil moisture meter employing neutron scattering was used to determine the moisture content at different times following water entry into the soil.

The neutron meter was found to be an excellent device for this type of study as the confounding of soil variation in sampling errors was eliminated.

471. Caestecker, K. De, and Leenheer, L. De. DECREASE OF FERTILITY UNDER THE INFLUENCE OF THE DETERIORATION OF THE STRUCTURE. (Fr) Cong. Internatl. de la Sci. du Sol. Rap. 6(B): 57-62. 1956 56.09 In8452
English summary.

A report was given on the soil fertility value of good soil structure for the clayey soils of the Belgium Sea Polder Region.

472. Camargo, A. P. De, and Costa, A. O. L. Da. DETERMINATION OF SOIL MOISTURE BY THE CALCIUM CARBIDE METHOD. (Por) Bragantia. 19(30): 493-502. 1960. 102.5 B73Tb
English summary.

The results were given for testing soil moisture samples by the calcium carbide method and these were compared with the results obtained by the oven drying method. The coefficient of correlation (r) was found to be .97.

473. Cambefort, H., and Caron, C. ELECTRICAL MEASUREMENTS OF SOIL POROSITY OR MOISTURE CONTENT. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 119-124. Ref. 1965. 291.9 In82

A report was given on the use of the electric resistivity measurements method and the thermal conductivity method for measuring soil porosity of moisture content of soils.

474. Cameron, J. F., and Bourne, M. S. A. GAMMA-SCATTERING SOIL DENSITY GAUGE FOR SUBSURFACE MEASUREMENTS. Internatl. J. Appl. Radiation and Isotopes. 3(1): 15-19. 1958. 334.8 In84

A gage for in situ measurements of soil densities with an accuracy of about one percent which can be used at depths down to 1000 feet was described. A complete design and method of calibration was given.

475. Campbell, A. P. HYDROLOGICAL CHARACTERISTICS OF SOILS. Symp. Hydrol. and Land Mangt. Proc. 1962: 16-19. 1963. 292.9 N484

A report was given on some hydrological characteristics of soils in New Zealand.

476. Carlson, C. A. APPROXIMATION OF THE FIELD MAXIMUM SOIL MOISTURE CONTENT. Soil Sci. Soc. Amer. Proc. 23: 403-405. 1959. 56.9 So3

Field maximum moisture content was defined as the recurring maximum moisture content of a soil layer in its natural position. An approximation of the field maximum was needed when daily moisture records were not available for selecting the recurring peak values. This paper presented the approximation of the field maximum moisture content for equations relating various soil and site properties.

Of the several factors investigated, the 0.06-atm. soil moisture tension value was the only single factor that correlated significantly with the field maximum; it accounted for about 68 percent of the variation in the field maximum values. With a simultaneous analysis, the sand content and the wetness index of the soil layer also were found to be primary factors in estimating the field maximum moisture content. Wetness index is an arbitrary classification that rates the potential maximum wetting of the 0- to 12-inch layer of soil and is dependent on the depth to a water table and the depth of wetting. Organic content and clay content were found to be secondary factors in the 0- to 6- and 6- to 12-inch layers, respectively. Equations using all factors accounted for about 80 percent of the variation in the field maximum values. The usefulness of the equations was evaluated by application to 533 sites located throughout the United States.

477. Carlson, C. A., and Pierce, R. S. THE FIELD MAXIMUM MOISTURE CONTENT. Soil Sci. Soc. Amer. Proc. 19: 81-83. 1955. 56.9 So3

The field maximum moisture content is defined as the naturally occurring wet limit of a soil or soil layer in its natural position. Values were obtained by selecting recurring peak values from daily records of soil-moisture content. For most soils the values tended to coincide with the 0.06 atmosphere soil-moisture tension values of core samples. In poorly drained soils the field maximum approached the total pore volume. The field maximum helped to characterize the full range of naturally occurring soil-moisture content.

478. Carter, D. L. A BIBLIOGRAPHY OF PUBLICATIONS IN THE FIELD OF SALINE AND SODIC SOILS (THROUGH 1961). U.S. Dept. Agr., Agr. Res. Serv. ARS 41-80: 47 pp. 1962. A56.9 R31

This bibliography resulted from a systematic search and review of the literature concerning saline and sodic soils. The papers are grouped under various headings which necessitated listing a small number of the references more than once.

This bibliography does not include all papers published on the subject of saline and sodic soils. Many foreign papers are not included, since access to extensive foreign literature was limited.

479. Cavazza, D. THE DETERMINATION OF SOIL MOISTURE; WE PRESENT A NEW METHOD. (It) Italia Agr. 95(6): 314-320. June 1958. 16 Itl

480. Cavazza, D. A NEW METHOD FOR SOIL MOISTURE MEASURING. (It) Irrigazione. 5(2): 158-164. Sept. 1958. 55.8 Ir733
English summary.

A method, developed in Italy, was given for measuring soil moisture based on variation of density (controlled by a suitable densimeter), which an alcohol test-sample undergoes at contact of the moisture contained in the soil test sample.

481. Cerkaski, M. RAPID DETERMINATION OF SOIL MOISTURE IN THE FIELD WITH THE AID OF THE V. E. KABAEV DEVICE. (Rum) Prob. Agr. [Bucharest] 15(2): 90-92. Feb. 1963. 21 R862

482. Ch'ai, H., Lang, H. C., Chin, S. J., Tsu, W. C., Chang, T. Y., and Ma, H. H. TYPES OF MARSHES IN THE EASTERN PART OF KIRIN PROVINCE AND THEIR AGRICULTURAL UTILIZATION. (Ch) Dili 1/4: 150-156. 1964. 331.8 T43

483. Chang, C. L. STUDIES ON THE CHARACTERISTICS OF SALINE SOILS IN THE YU-PEI PLAIN AND THEIR UTILIZATION AND RECLAMATION. (Ch) Zhongguo Nongye Kexue. 8: 39-43. Aug. 1963. 22.5 N928

484. Chang, C. W. A NEW METHOD FOR MEASURING MOISTURE RETENTION VALUES AND STABILITY OF STRUCTURE OF SODIUM-AFFECTED SOILS. Internatl. Cong. Soil Sci. Trans. 7(1): 217-224. Ref. 1960. 56.09 In847T

Three new procedures were discussed for measuring moisture retention values and stability of structure of sodium-affected soils.

485. Chang, Y. T. EFFECTS OF SOIL MOISTURE CONTROL AND IRRIGATION ON CROP PRODUCTION IN UPLAND FIELDS. (Ch) Taiwan Water Conserv. (ser. 11) 3(43): 15-28. Ref. Sept. 1963. 292.8 T13
English summary.

A report was given on the use of gypsum blocks in China to determine the available moisture in the soil to control soil moisture and to determine when to irrigate upland fields.

486. Chapman, V. J., ed. SALT MARSHES AND SALT DESERTS OF THE WORLD. Intersci. Pub., Inc., N.Y. 392 pp. 1960. 56.2 C36

A report was given of the salt marshes throughout the world, and their economic uses.

487. Chapovskaya, E. V. LYSIMETRIC STUDY OF THE ELEMENTS OF THE WATER BALANCE OF A COTTON FIELD IN THE GISSAR VALLEY. (Rus) Akad. Nauk Tadzhikskoi SSR. Dok. 4(5): 31-34. 1961. 511 Ak193D

488. Chatfield, M. G., and Mulligan, H. P. NEW AID FOR MEASURING SOIL MOISTURE. Power Farming Austral. and New Zeal. and Better Farming Digest. 73(4): 13. Apr. 1964. 58.8 P87

A soil moisture measuring block developed in New South Wales was described. The blocks are gypsum impregnated and have monel metal mesh electrodes and fiber glass insulation.

489. Chen, S. D. GENETIC AND REGULARITY IN THE OCCURRENCE OF SODIC SALINE SOILS IN NORTH-EAST CHINA. (Hu) Agrokem. es Talajtan. 10(1): 13-22. Feb. 1961. 385 Ag83
English summary.

A report was given of the classification and occurrence of sodic saline soils in Northeast China.

490. Chia, S., and Chin, S. J. THE TYPES, ORIGINS AND EVOLUTION OF THE MARSHES ON THE NORGAI PLATEAU. (Ch) Acta Geog. Sinica. 29(3): 219-240. map. Sept. 1963. 331.8 T45 Russian summary.

491. Childs, E. C. RECENT ADVANCES IN THE STUDY OF WATER MOVEMENT IN UNSATURATED SOIL. Cong. Internatl. de la Sci. du Sol. Rap. 6(B): 265-274. Ref. 1956. 56.09 In8452

A physical theory of the development of soil moisture profiles was given. The problem was of the following parts: (1) The determination of the hydraulic conductivity of unsaturated soil as a function of the moisture content; and (2) the solution of certain equations, derived from Darcy's law which have the character of the diffusion equation with modifications and with diffusity dependent upon moisture contents. Methods of solving these problems were surveyed down to the present time.

492. Childs, E. C. THE PHYSICS OF LAND DRAINAGE. In Luthin, J. N. ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 1-78. 1957. 4 Am392

A review of the literature and a discussion were given of the physics of land drainage under the following headings: I. The Nature of Soil Constituents; II. The International Soil Architecture; III. The Static Equilibrum of Soil Water; IV. The Laws of Soil Water Movement; and V. The Physical Nature of Drainage Problems.

493. Chuprin, I. A. A NEW VOLUMETRIC METHOD FOR DETERMINATION OF SOIL MOISTURE. (Rus) Gidrotekh. i Melior. 7(10): 47-49. Oct. 1955. 290.8 G362

494. Ciesla, W., and Marcinek, J. CHARACTERISTICS OF PODZOLIC AND MEADOW PEAT SOILS IN THE STATION OF VARIETY EVALUATION IN NOWAWIES UJSKA INCLUDING THEIR CHEMICAL AND PHYSICO-CHEMICAL FEATURES. (Pol) Poznan. Wyzsza Szkola Roln. Rocz. 15: 115-132. 1963. 106.2 P872 English summary.

Chemical and physical characteristics of podzolic and meadow peat soils were given. A discussion was included on the need of drainage and fertilization for the meadow peat soils in the U.S.S.R.

495. Clark, F. E., and Resnicky, J. W. SOME MINERAL ELEMENT LEVELS IN THE SOIL SOLUTION OF A SUBMERGED SOIL IN RELATION TO RATE OF ORGANIC MATTER ADDITION AND LENGTH OF FLOODING. Cong. Internatl. de la Sci. du Sol. Rays. 6(C, colloque de Riz): 545-548. 1956. 5609 In In8452

A report was given on the effect of rice straw and length of flooding on mineral element levels in a soil solution of a submerged soil. The levels of Na, K, Ca, Mg, Fe, and Mn in the soil solution varied with rate of organic matter and with length of submersion. Levels of Al, Cu, and B decreased with time with no significant differences in their level due to straw treatment.

496. Clark, H. L. CAPABILITY OF LOUISIANA MARSH SOILS. Rice J. 64(13): 9-11. map. Dec. 1961. 59.8 R36

A report was given on the capability of marsh soils in Louisiana for growing rice and cattle. Only the shallow, firm, fresh marsh peat soils, and the firm, mineral fresh marsh soils can be used safely for permanent cultivation in the area. Deep firm peat soils can be used safely for native range or wildlife.

497. Clark, J. S., Gobin, C. A., and Sprout, P. N. YELLOW MOTTLES IN SOME POORLY DRAINED SOILS OF THE LOWER FRASER VALLEY BRITISH COLUMBIA. Canad. J. Soil Sci. 41(2): 218-227. map. Ref. Aug. 1961. 56.8 C162

Chemical and mineralogical studies were made of yellow mottles and brown tubular formation in some strongly acid, poorly drained soils of British Columbia, Canada.
It was postulated that the yellow mottles were formed by the reduction of sulphates in the seepage waters from these rivers to sulphides and the subsequent oxidation of the sulphides to the basic ferric sulphate.

498. Closs, R. L., and Jones, R. L. THE CONSTRUCTION AND INSTALLATION OF GYPSUM SOIL-MOISTURE METERS. New Zeal. J. Sci. and Technol. B., Gen. Res. Sect. 37: 150-157. Sept. 1955. 514 N48B

The construction, installation, and use of gypsum soil-moisture meters was discussed for use in New Zealand.

499. Cole, D. W. ALUNDUM TENSION LYSIMETER. Soil Sci. 85(6): 293-296. Ref. June 1958. 56.8 So3

A type of lysimeter was described that was constructed from a porous alundum disc, a tension column, and a receiving container for periodic removal of the leacate.

500. Cole, D. W., Corey, R. B., Murdock, J. T., and Wilde, S. A. EXTENT OF CAPILLARY FRINGE IN SOILS OF SANDY OUTWASH AS DETERMINED BY THE USE OF RADIOSULFUR. Forestry Res. Notes 41, 2 pp. June 1957. 99.8 F76292

A report was given of the extent of capillary fringe in sandy outwash soils as determined by the use of radiosulfur. There was a maximum concentration of radiosulfur 20 inches above the ground water table.

501. Collis-George, N., and Evans, G. N. A TWO-WELL METHOD OF DETERMINING THE HYDRAULIC CONDUCTIVITY OF DISCRETE LAYERS IN LAYERED SATURATED SOILS IN THE FIELD. Austral. J. Soil Res. 2(1): 8-19. June 1964. 56.8 Au7

A steady-state method of hydraulic conductivity determination in saturated soils, with particular application to use in discrete soil layers, was presented and discussed. It utilizes two partially lined auger holes with mutually opposite hydraulic conducting surfaces positioned in the desired layer.

The use of an electrolytic tank analogue to determine a necessary geometric factor was described. Some representative field and analogue results were given.

502. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON ESTIMATION OF SOIL MOISTURE BY DIELECTRIC LOGS (1960-1933). Commonwealth Bur. Soil Sci. [Annot. Bibliog.] 3 pp. Feb. 1961. 241 C734A

An annotated bibliography was given of articles published during 1933-60 on estimation of soil moisture by dielectric logs.

503. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON INFILTRATION INTO SOIL AS AFFECTED BY RAINFALL INTENSITY (1964-1940). Commonwealth Bur. Soils [Annot. Bibliog.] 723, 5 pp. 1964. 241 C734A

An annotated bibliography was given on the effect of rainfall intensity on infiltration into the soil for the period 1940-1964.

504. Connecticut Agricultural Experiment Station. DATA ON LEACHING OF WATER IN SOILS OBTAINED FROM LYSIMETERS AT THE TOBACCO LABORATORY, WINDSOR. CONNECTICUT. New Haven, Conn. 8 pp. 1955. 56.43 C762

Data were given on leaching of water in soils from lysimeters in Connecticut.

505. Copeland, O. L., Jr. A STUDY OF THE INFLUENCE OF MOISTURE AND COMPACTION ON SOIL OXIDATION-REDUCTION POTENTIALS. Soil Sci. Soc. Amer. Proc. 21: 269-271. 1957. 56.9 So3

The effects of two moisture levels and two degrees of compaction on the oxidation-reduction potentials of 17 soils were investigated during an incubation period of 8 weeks. Soils receiving the optimum moisture-no compaction treatment maintained the highest potentials throughout the incubation period, while the saturated-high compaction series developed the lowest potentials. Apparently, the Hagerstown soil used in this study possesses a high degree of poise against reducing conditions. This is shown by the failure of drastic treatments involving compaction and saturation to lower the potentials by large values. The positive poising capacity is attributed to large quantities of hydrated iron oxides present within the soil, coupled with tl paucity of active organic matter.

506. Corey, A. T. MEASUREMENT OF WATER AND AIR PERMEABILITY IN UNSATURATED SOIL. Soil Sci. Soc. Amer. Proc. 21(1): 7-10. 1957. 56.9 So3

Equipment developed for the measurement of oil and gas flow in oil producing sands was used to study unsaturated permeability in a soil. The method employs the simultaneous flow of air and water under the same pressure gradient to maintain a uniform tension and, as a consequence, a uniform saturation within the sample during permeability measurements. The saturation was reduced in increments by reducing the water pressure with respect to the air pressure.

Results of unsaturated permeability measurements on two relatively undisturbed samples of a sandy soil were presented. The interrelationship between gas and liquid permeabilities as a function of saturation was discussed, and a method of calculating the unsaturated water permeability from the more easily measured air permeabilities was suggested.

507. Corey, G. L., and Fitzsimmons, D. W. INFILTRATION PATTERNS FROM IRRIGATION FURROWS. Idaho Agr. Expt. Sta. Res. B. 59, 16 pp. 1962. 100 Id1

The theory, apparatus, and procedures for studying unsaturated flow from irrigation furrows with an electric analog were presented.

The wetted perimeter of a furrow was an important variable when considering the quantity of water which was discharged from it into the soil.

The results indicated that the depth of soil below the furrow had little effect on the discharge.

The results are preliminary in that the analysis was based entirely on the assumptions that the soil profile was uniform, the furrow spacing was 30 inches, and the flow was steady state.

508. Covey, W., and Bloodworth, M. E. MATHEMATICAL STUDY OF THE FLOW OF WATER TO PLANT ROOTS. Tex. Agr. Expt. Sta. Misc. P. 599, 15 pp. Aug. 1962. 100 T31M

A mathematical study of the flow of water to plant roots was given. The study was made by the use of a computer.

509. Curry, R. B., and Strach, Z. RESEARCH ON SEEPAGE CONTROL. Ohio Farm and Home Res. 48(5): 69-70. Sept./Oct. 1963. 100 Oh3S

A report was given on research in Ohio on seepage control by a basic study of the physics of flow of collodial clay suspensions in porous media.

510. Cutting, C. V. SOILS OF THE ELEPHANT MARSH; A NOTE ON THE PROPOSED RECLAMATION. Nyasaland Farmer and Forester. 3(4): 15-16. May 1957. 24 N984

Research results were given of a soil study of an old irrigated area in Nyasaland that was made so the the area could be properly drained and some alkaline areas reclaimed to improve the irrigation project.

511. Czekalski, A., and Kocialkowski, Z. SPECTROANALYTIC DETERMINATION OF MACRO- AND TRACE ELEMENTS CONTENT IN DRAINAGE WATERS. (Pol) Rocz. Gleboznawcze. 13(sup.): 238-243. 1963. 56.8 R592
English summary.

A report was given of the spectroanalytic determination of macro- and trace elements contained in some drainage waters of Poland. The highest values were obtained during the summer months.

512. Danfors, E. NEUTRON-RADIATION FOR DETERMINATION OF MOISTURE CONTENT. (Sw) Grundforbattring. 16(4): 244-255. Ref. 1963. 54.8 G92
English summary, pp. 292-293.

A report was given on the design and functions of the neutron-radiation method for soil moisture determination. Soil factors were discussed that affect the measurement of soil moisture.

513. Danfors, E., and Nilsson, L. THE APPLICATION OF THE NEUTRON METHOD FOR MOISTURE MEASUREMENTS IN SOILS. (Sw) Grundforbattring. 16(4): 277-284. 1963. 54.8 G92
English summary, pp. 294.

A report was given on the application of the neutron radiation method for soil moisture measurement in Sweden.

514. Danfors, L. E. A STUDY OF SOIL AERATION DURING DRAINAGE, USING THE PLATINUM MICROELECTRODE TECHNIQUE. Diss. Abs. 22(5): 1325-1326. Nov. 1961. 241.8 M58

A study was reported of soil aeration during drainage by the use of the platinum microelectrode technique. Measurement of the oxygen diffussion rate (ODR) were made at five locations in Michigan and Ohio to study the effects of different methods and intensities of drainage on soil aeration.

515. Davidson, J. M., Biggar, J. W., and Nielsen, D. R. GAMMA-RADIATION ATTENUATION FOR MEASURING BULK DENSITY AND TRANSIENT WATER FLOW IN POROUS MATERIALS. J. Geophysical Res. 68(16): 4777-4783. Ref. Aug. 15, 1963. 470 J823

A laboratory method, based on γ-radiation attenuation, was described for studying transient water flow in packed soil columns. The γ rays from a 200-millicurie source of Cs^{137} are collimated through a narrow slit, and the beam is then focused on a soil column. A radiation analyzer in the circuit allows only primary rays of energy 0.66 ± 0.15 Mev to be recorded. Both bulk density (g/cm^3) and water content of the soil (g/cm^3) can be calculated using an absorption equation. This method makes possible rapid and frequent measurement of the water content of soil as a function of time and position without disturbing the soil-water system. Experimental results for water moving into a uniformly packed air-dry soil were presented.

516. Davidson, J. M., Nielsen, D. R., and Biggar, J. W. THE MEASUREMENT AND DESCRIPTION OF WATER FLOW THROUGH COLUMBIA SILT LOAM AND HESPERIA SANDY LOAM. Hilgardia. 34(15): 601-617. Ref. Sept. 1963. 100 C12H

Experimental data were presented for water entering air-dry soils in the horizontal and vertical position. Theoretical and experimental procedures were discussed to describe this flow of water through Columbia silt loam and Hesperia sandy loam. A method of measuring the unsaturated capillary conductivity was presented.

517. Davidson, J. M., Nielsen, D. R., and Perrier, E. R. INFLUENCE OF TEMPERATURE ON SOIL MOISTURE NEUTRON PROBES. Soil Sci. Soc. Amer. Proc. 23(3): 251-252. May/June 1959. 56.9 So3

It was found that erroneous measurements of soil moisture may be taken with the neutron probes due to the effect of temperature on electrical components in the preamplifier of the probe.

518. Davis, J. F., and Lucas, R. E. ORGANIC SOILS, THEIR FORMATION, DISTRIBUTION, UTILIZATION AND MANAGEMENT. Mich. Agr. Expt. Sta. Spec. B. 425, 156 pp. 1959. 100 M585

This manual on organic soils is divided in the following main parts: (1) Organic soils, their formation, distribution, utilization, and management; (2) water control; (3) nutrient requirements of crops; (4) fertilizer placement on muck soils; (5) soil testing; (6) adapted crops; (7) commercial uses of peat; and (8) selected list of references for organic soils.

519. Davis, R. D., and Bidwell, O. W. THE ENGINEERING APPLICATION OF AGRICULTURAL SOIL SURVEYS. Kans. Acad. Sci. Trans. 66(3): 401-408. 1963. 500 K13T

Engineering properties were determined and 10 of the 32 soil types and phases recognized in the Logan County, Kans., soil survey were classified.

The U.S.D.A. testural types assigned as a result of laboratory analyses or by field "feel methods" closely agreed with the mechanical analyses of all horizons of the ten soil profiles.

Other interpretations which often are included in the engineering chapters of soil survey reports are tendency to slough or slide, suitability as a source of topsoil, and suitability for: Farm ponds; erosion control terraces; levees; irrigation; artificial drainage; building foundations; and sewage disposal beds.

520. Dawson, J. E. ORGANIC SOILS. Advn. Agron. 8: 377-401. Ref. 1956. 30 Ad9

A review of the literature was given on the formation, subsidence under drainage, and chemical properties of organic soils.

521. Deb, A. K., and Singh, A. FIBRE GLASS ELECTRICAL RESISTANCE MOISTURE METERS FOR LONG TERM MEASUREMENT OF IN SITU SOIL MOISTURE. Indian Soc. Soil Sci. J. 11(1): 65-68. Mar. 1963. 56.9 In2

A report was given on the use of fiber glass electrical resistance moisture meters for long term measurement of in situ soil moisture in India.

522. Deckers, J. HYDROMORPHIC SOILS OF THE HIGH PLATEAU OF BELGIAN ARDENNES AND THEIR UTILIZATION. (Fr) (Abs.) Cong. Internatl. de la Sci. du Sol. Rap. 6(A): 263. 1956. 56.09 In8452

523. Delver, P., and Kadry, L. T. ESTIMATION OF SATURATION-EXTRACT CONDUCTIVITIES FROM SATURATION-PASTE CONDUCTIVITIES AND TEXTURES FOR SALINE SOILS IN THE MESOPOTAMIAN PLAIN. Internatl. Cong. Soil Sci. Trans. 7(II): 370-377. 1960. 56.09 In847T

In order to enable large scale soil salinity testing with a limited laboratory capacity, the relation between saturation-paste and saturation-extract conductivities (EC_8 and EC_e) was studied for a number of soil samples originating from four different areas in the Mesopotamian plain in Iraq. The ratio $f = EC_e/EC_8$ proved to be hyperbolically related to the moisture-content at saturation point (SP) and the salinity level expressed as EC_8. A method was described for estimating EC_e from simple electrical conductivity measurements in soil pastes (EC_8) and SP-values.

524. Dendy, F. E., and Asmussen, L. E. PERMEABILITY MEASUREMENTS WITH SMALL WELL POINTS. Trans. ASAE 6(4): 297-300, 303. 1963. 290.9 Am32T

The well-point method of determining in situ permeabilities of water-saturated strata was adapted for use with a vacuum-type drill rig. Laboratory investigations were reported that indicated reasonably accurate measurements can be obtained under favorable conditions.

525. De Plater, C. V. A PORTABLE CAPACITANCE TYPE SOIL MOISTURE METER. Soil Sci. 80(5): 391-395. Nov. 1955. 56.8 So3

A portable meter was described for the rapid determination of soil moisture in terms of electrical capacitance. The meter was designed for use with a probe.

526. Dermott, W. THE DETERMINATION OF SOIL MOISTURE. U. Col. Wales. Welsh Soils Discuss. Group. Rep. 4: 11-16. 1963. 56.9 Un32
Discussion, p. 48-51.

A report was given on the method used to measure soil moisture in the laboratory and field in Wales.

527. Dickey, D. D., Ferguson, H., and Brown, P. L. INFLUENCE OF NEUTRON METER ACCESS TUBES ON SOIL TEMPERATURE AND WATER UNDER WINTER CONDITIONS. Soil Sci. Soc. Amer. Proc. 28(1): 134-135. Jan./Feb. 1964. 56.9 So3

The influence was reported of neutron meter access tubes on soil temperature and water movement under winter conditions. In no case was the temperature at 2 inches from the tubes appreciably lower than at a similar depth further away from the tubes so, no horizontal movement of water due to temperature gradient would be expected.

528. Dirksen, C. WATER MOVEMENT AND FROST HEAVING IN UNSATURATED SOIL WITHOUT AN EXTERNAL SOURCE OF WATER. Diss. Abs. 25(6): 3177. Dec. 1964. 241.8 M58

An abstract was given on an experiment in New York on the water movement and frost heaving in unsaturated soils without an external source of water.

529. Dobrzanski, B. AN ELECTRIC HYGROMETER FOR MEASURING MOISTURE IN SOILS FORMED FROM SANDS. (Pol) Rocz. Gleboznawcze. 10(sup.): 628-630. 1961. 56.8 R592

530. Dobrzanski, B., Glinski, J., and Guz, T. TERRACING OF ERODED SLOPES AS A SOIL-FORMING FACTOR IN THE BASINS OF THE RIVERS BIALA WODA AND CZARNA WODA. (Pol) Rocz. Gleboznawcze. 9(2): 69-85. 1960. 56.8 R592
English summary.

A report was given of the effect of terracing as a soil forming factor on eroded slopes in Poland.

531. Dobrzanski, B., Glinski, J., and Malicki, M. ELECTRICAL RESISTANCE METHOD FOR MEASURING MOISTURE DYNAMICS IN SANDY SOILS. Rocz. Gleboznawcze. 14(sup.): 15-21. 1964. 56.8 R592

A report was given on the use of the electrical resistance method (wheatstone bridge) for measuring soil moisture in sandy soils in Poland.

532. Dodd, J. D., Rennie, D. A., and Coupland, R. T. THE NATURE AND DISTRIBUTION OF SALTS IN UNCULTIVATED SALINE SOILS IN SASKATCHEWAN. Canad. J. Soil Sci. 44(2): 165-175. 1964. 56.8 C162

Investigations were undertaken to ascertain the relative abundance of various salts in uncultivated saline soils occurring in southern Saskatchewan. Sampling sites were selected within areas dominated by various native plant species and groups of species. One hundred and nineteen saline profiles in the Brown, Dark Brown, and Black soil zones were studied and classified into five sub-group profile types, which were usually associated in a catenary sequence.

The Saline Gleyed Regosol occupied the central portion of depressional area, followed successively by the Saline Gleysol, and the Saline Meadow, with the Saline Calcareous Chernozem occupying the perimeter of the depression and the Saline Rego Chernozem being transitional to upland soil.

533. Doering, E. J. A DIRECT METHOD FOR MEASURING THE UPWARD FLOW OF WATER FROM THE WATER TABLE. Soil Sci. 96(3): 191-195. Sept. 1963. 56.8 So3

A method was described for the direct measurement under field conditions of the vertical flow of water in the vicinity of the water table. The relationship of such measurements to evaporation from fallow surfaces and evapotranspiration from cropped surfaces was discussed. The method is applicable to either homogeneous or stratified soil profiles, and a method for installing the necessary equipment was described. The equipment is simple and inexpensive, requires very little maintenance, and is responsive to small changes in the flow rate. An evaporation rate of 0.036 ± 0.0024 inch per day was measured for a fallow soil in Imperial County, Calif.

534. Doering, E. J., and Decker, D. L. APPARATUS FOR MEASURING LOW RATES OF WATER FLOW. Soil Sci. Soc. Amer. Proc. 28(5): 716-718. Sept./Oct. 1964. 56.9 So3

The inexpensive drop-counting apparatus described utilizes the electrolytic conduction of the drop and consists of three elements—the dropper assembly, the amplifier, and the chronograph. It has functioned satisfactorily during more than a year of almost continuous use.

535. Doering, E. J., Reeve, R. C., and Stockinger, K. R. SALT ACCUMULATION AND SALT DISTRIBUTION AS AN INDICATOR OF EVAPORATION FROM FALLOW SOILS. Soil Sci. 97(5): 312-319. May 1964. 56.9 So3

The loss of water from field soil profiles with a water table at an average depth of 152 cm. was calculated from measurements of salt accumulation in various layers, with suitable adjustments being made for the molecular diffusion of salts downward from the surface and changes in the water content of the soil. Measurements of both the total soluble salt content and the chloride ion content were made as a function of both depth and time (1029 days) in initially leached and initially unleached plots. The surface remained fallow during the entire period. The capacity of the soil to transmit water upward (not the evaporative potential at the surface) limited the flow rate at all times during the study.

536. Donahue, R. L. SOILS: AN INTRODUCTION TO PLANT GROWTH. Prentice-Hall, Inc. 349 pp. 1958. 56 D712S

In this textbook on the fundamental and applied soil science, several chapters were devoted to drainage, irrigation, salinity control, soil physics, soil chemistry, and soil genesis and classification.

537. Donahue, R. L. OUR SOILS AND THEIR MANAGEMENT (AN INTRODUCTION TO SOIL AND WATER CONSERVATION). Ed. 2. Interstate Print. and Pub., Inc. 568 pp. 1961. 56.7 D71

A revised edition was given to a book on soils and their management. Several chapters were given that were devoted directly or indirectly to the use and need of land drainage.

538. Donnan, W. W., and Aronovici, V. S. FIELD MEASUREMENT OF HYDRAULIC CONDUCTIVITY. J. Irrig. and Drain. Div. ASCE 87(IR2): 1-13. June 1961. 290.9 Am3Ps

The work carried on to develop a device for the measurement of hydraulic conductivity of the soil strata to be drained was described. A field well point was developed in the laboratory and tested in the laboratory and the field with good results. The method of making the field well points was described and a technique for field installation and operation of the device was outlined.

539. Donnan, W. W., and Aronovici, V. S. FIELD MEASUREMENT OF HYDRAULIC CONDUCTIVITY. J. Irrig. and Drain. Div., ASCE 87(IR2, 1): 1-13. June 1961. 290.9 Am3Ps

A report was given on the field measurement of hydraulic conductivity by use of a small, brass, screen-type well point inserted in the soil below the water table. These well points were described and illustrated and a field technique was given for the installation and operation of the device.

540. Donnan, W. W., and Aronovici, V. S. FIELD MEASUREMENT OF HYDRAULIC CONDUCTIVITY. Amer. Soc. Civil Engin. Trans. 128(3): 103-116. 1963. 290.9 Am3

The work carried on to develop a device for the measurement of hydraulic conductivity was described. Laboratory studies resulted in the adoption of a small, brass, screen-type well point which could be inserted in the soil below the water table. The rate at which water was pumped out of the well point related directly to the conductivity of the strata being tested.

Field-type well points were developed, using ordinary hardware pipe fitting. The field well points were then tested in the laboratory and in the field with good results.

The way to make the field well points was described and the technique for field installation and operation of the device was outlined.

541. Dooley, W. E. A STUDY OF THE POSSIBILITIES OF PEATLAND RECLAMATION IN IRELAND AND A SUGGESTED PLAN FOR ITS IMPLEMENTATION. Diss. Abs. 20(5): 1734. Nov. 1959. 241.8 M58

An abstract was given on the classification, formation, and distribution of peat bogs in Ireland. A suggested plan was given for the reclamation and farming of these bogs.

542. Doorn, Z. Van. SOME OBSERVATIONS ON ORIGINAL PEAT BOGS IN INDONESIA FOR COMPARISON WITH THE HOLLAND-UTRECHT PEAT AREA. (Du) Boor en Spade. 10: 156-170. map. 1959. 56.9 B64 English summary.

The Holland-Utrech peat areas were described as to the way they are now and compared with some original peat bogs in Indonesia. The Holland-Utrech peat areas owe their special characteristic to their origin and to the nearly 1000 year old reclamation and ensuring development.

543. Douglass, J. E. A METHOD FOR DETERMINING THE SLOPE OF NEUTRON MOISTURE METER CALIBRATION CURVES. U.S. Forest Serv. Southeastern Forest Expt. Sta. Sta. Paper 154, 6 pp. Dec. 1962. 1.9622 S4St2

A new method was given for determining the slope of neutron moisture meter calibration curves.

544. Dreibelbis, F. R. AVERAGE MONTHLY PERCOLATION FROM THE COSHOCTON MONOLITH LYSIMETERS, 1938-1955. J. Soil and Water Conserv. 12(2): 85-86. March 1957. 56.8 J822

A report was given on the results of lysimeter research at Coshocton, Ohio.

545. Dreibelbis, F. R. COMPARISON OF THE SOIL MOISTURE REGIMEN IN LYSIMETERS WITH THAT ON ADJACENT WATERSHEDS. U.S. Dept. Agr. Res. Serv. ARS 41-47, 18 pp. Oct. 1961. A56.9 R31

Comparison of the soil moisture regimen in lysimeters with that on adjacent watersheds has hydrologic implications that have an important bearing on soil and water conservation research. The data indicated that extrapolation from small areas to larger ones was not simple. Such factors as soil profile characteristics, position and elevation on the slope, soil moisture levels, and the possibilities of lateral flow must be considered in making these extrapolations.

546. Dreibelbis, F. R. SOME ASPECTS OF WATERSHED HYDROLOGY AS DETERMINED FROM SOIL MOISTURE DATA. J. Geophys. Res. 67: 3425-3435. Aug. 1962. 470 J823

The soil moisture distribution in 8-foot profiles on four watersheds indicated that the zone of major hydrologic activity was in the upper 12 inches of soil and particularly in the 0- to 7-inch A horizon. The average seasonal moisture curves of three locations on three watersheds were compared with those of their respective adjacent lysimeters.

547. Drebelbis, F. R. LAND USE AND SOIL TYPE EFFECTS OF THE SOIL MOISTURE REGIMEN IN LYSIMETERS AND SMALL WATERSHEDS. Soil Sci. Soc. Amer. Proc. 27(4): 455-460. 1963. 56.8 So3

Agronomic practices had a pronounced effect on both the rate and amount of extraction of moisture as determined by studies on the soil moisture regimen in lysimeters and small watersheds. These effects influenced water storage opportunity in the soil profile with its possible influence on infiltration, surface runoff, and percolation.

Soil type effects on the moisture regimes were more noticeable in extraction patterns with depth than in the overall water budget.

Both rates and amounts of moisture extraction from a woodland watershed were much greater during the summer and early fall than from pasture.

548. Dreibelbis, F. R. USE OF THE NUCLEAR PROBE IN STUDIES OF THE SOIL MOISTURE REGIMEN ON LYSIMETERS AND SMALL WATERSHEDS. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 2: 106-115. 1965. 291.9 In82

Resistance blocks and neutron scattering equipment was used to obtain soil moisture data on small watersheds and on monolith lysimeters. The reliability of the probe and blocks was confirmed by comparing with data from the weighing lysimeter.

549. Dreibelbis, F. R., and Amerman, C. R. LAND USE, SOIL TYPE, AND PRACTICE EFFECTS ON THE WATER BUDGET. J. Geophysical Res. 69(16): 3387-3393. 1964. 470 J823

Analyses of data from lysimeters and small watersheds near Coshocton, Ohio, indicated the effects of various soil and agronomic factors on the magnitude of the several elements of the water budget. From lysimeter data, the effects of soil types and agronomic practices upon the magnitude of evapotranspiration (ET) were shown for corn, wheat, and meadow in a 4-year rotation.

550. Dreibelbis, F. R., and McGuinness, J. L. PLANT-NUTRIENT LOSSES IN LYSIMETER PERCOLATES. Agron. J. 49(10): 523-527. Ref. Oct. 1957. 4 Am34P

A report was given on plant nutrient losses from lysimeter studies in Ohio.

551. Druzhinin, I. G., and Isaev, D. I. PEAT BEDS IN KIRGIZ SSR. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 147-157. 56.33 R922

552. Dunkel, K. H. COMPARISON OF DIFFERENT METHODS FOR THE RAPID DETERMINATION OF THE WATER CONTENT OF THE SOIL. (Ge) Internatl. Hort. Cong. (Proc). 16(2): 246-252. Ref. 1962, pub. 1963. 90.09 C7616P
Includes discussion.

553. Dupriez, G. L. THE THORNTHWAITE LYSIMETRIC VESSEL, AS AN INSTRUMENT FOR THE MEASUREMENT OF EVATRANSPIRATION IN TROPICAL REGIONS.

A report was given on the use of two lysimetric pans to study evapotranspiration in Belgium Congo and Ruanda-Urundi following the principle involved by Thornthwaite.

554. Dylla, A. S., and Tovey, R. PLASTIC MEMBRANE TANKS. Agr. Engin. 43(10): 584-585. Oct. 1962. 58.8 Ag83

The use of polyvinal plastic films for making non-weighing lysimeters was described and illustrated.

555. Dzubay, M. STUDY OF SOME FACTORS IN THE SECONDARY ALKALINIZATION PROCESSES AT KELEMENZUG. (Hu) Agrokem. es Talajtan. 13 (1/2): 39-50. Ref. July 1964. 385 Ag83
French summary.

556. Eagleman, J. R., and Jamison, V. C. THE INFLUENCE OF SOIL TEXTURAL STRATIFICATION AND COMPACTION ON MOISTURE FLOW. Mo. Agr. Expt. Sta. Res. B. 784, 14 pp. Oct. 1961. 100 M693

The characteristics of moisture flow at the plan of contact of soil layers differing in texture, structure, and compaction was determined in a laboratory study.

557. Eck, H. V., and Stewart, B. A. WATER RETENTION PROPERTIES OF SEVENTEEN OKLAHOMA SOILS. Okla. Agr. Expt. Sta. B. B-526, 12 pp. 1959. 100 OK4

The bulk density, moisture equivalent, 15-atmosphere percentage, and available water capacity data were presented for 17 soil types. For those soil types for which more than one location was sampled, the data in the tables were averages of the locations sampled. In cases where only one location per type was sampled, the data were values for that location. Available water capacity expressed in percent was calculated by subtracting the moisture percentage at 15-atmospheres from the moisture percentage at moisture equivalent. Available water capacity in inches per section was calculated by the following formula:

$$\frac{\text{Bulk density x depth increment (in.) x available moisture percentage}}{100} =$$

Available water capacity (inches of water)

The available water found ranged from 16.44 inches in the Tabler silt loam to only 9 inches in the Minco loam.

558. Edelman, C. H., and Staveren, J. M. Van. MARSH SOILS IN THE UNITED STATES AND IN THE NETHERLANDS. J. Soil and Water Conserv. 13(1): 5-17. Jan. 1958. 56.8 J822

The authors toured the Gulf Coast between Houston, Tex., and Pascagoula, Miss., and the East Coast between Brunswick, Ga., and Toms River, N.J. to look at the marsh soils and to assess—in the light of experience in the Netherlands—the possibility of reclaiming them. Part I dealt with the soils and Part II dealt with problems of drainage.

559. Egorov, V. V. SALINIZATION AND CONDITIONS FOR THE IMPROVEMENT OF THE MARINE DELTA AREA OF THE ARALO-CASPIENNE REGION. (Fr) Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comn. VI): 525-530. 1956. 56.09 In8452
English summary.

The solonetz soils in the inland sea delta soils in Russia were found to be due to the evaporation of fresh ground waters at first and later by the evaporation of the highly mineralized ground waters. Both stages of salinization have to be considered when the areas are artifically drained.

560. Egorov, V. V. THE CONNECTION BETWEEN TAKYR FORMATION AND SALINIZATION. (Rus) In Leningrad Pochvennyi Institut Imeni V. V. Dokuchaeva. VOPROSY GENEZISA I GEORGRAFII POCHV. Moskva, Akademiia Nauk SSSR. pp. 270-290. Ref. 1957. 56.1 L54

561. Ehlig, C. F., and Gardner, W. R. THE MOVEMENT OF WATER TO PLANT ROOTS. Crops and Soils. 14(9): 24-25. 1962. 6 W55

The water content, in terms of percent, and the soil moisture tension was measured in the root zone during several irrigation cycles. Birdsfoot trefoil, ryegrass, cotton, dwarf milo, and pepper were used as test crops.

Calculations were made to determine the relative amount of water moving upward through the soil and through the plant root system. Results showed that an important fraction of the water in the lower portions of the root zone moved upward through the soil as much as 1 foot or more before entering the plant roots.

562. El Gibaly, H. THE VALUE OF THE COEFFICIENT OF THE HYDRAULIC PERMEABILITY OF ASSUIT SOILS AND THE EFFECT OF SOME TREATMENTS ON ITS MAGNITUDE. Cong. Irrig. and Drain. Trans. 5(4): R.16.225-R.16.231. 1963. 55.9 C7652

A report was given on the use of the coefficient of the hydraulic permeability of Assuit soils in the U.A.R. for determining the efficiency of irrigation and drainage projects.

563. Elkins, C. B., Jr., Williams, G. G., and Ritchie, F. T., Jr. SOIL MOISTURE CHARACTERISTICS OF SOME SOUTHERN PIEDMONT SOILS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-54, 22 pp. 1961. A56.9 R31

Certain physical properties and moisture characteristics of selected Piedmont soils in Georgia were reported. These include the texture, bulk-density, percent moisture by volume at specified tensions, and available water-holding capacity by 6-inch increments of depth to 6 feet in the soil profile. Profile descriptions were also included for 14 sites.

564. Elrick, D. E., and Bowman, D. H. NOTE ON AN IMPROVED APPARATUS FOR SOIL MOISTURE FLOW MEASUREMENTS. Soil Sci. Soc. Amer. Proc. 28(3): 450-453. May/June 1964. 56.9 So3

An improved apparatus was described and illustrated for measuring soil moisture flow in Canada.

565. Emel'yanov, V. A. NEUTRON MOISTURE METER. (Rus) Gidrotekh. i Melior. 9: 34-40. Sept. 1964. 290.8 G362

566. Emel'yanov, V. A., Beskin, L. I., and Osipov, V. I. NEUTRON METHOD FOR MEASURING SOIL MOISTURE CONTENT AND ITS FUTURE. (Rus) Pochvovedenie. 7: 109-115. July 1963. 57.8 P34
English translation—Soviet Soil Sci. 7: 708-714. July 1963. 57.8 P34Ae

A report was given on the present and future use of the neutron meter for measuring soil moisture content in the U.S.S.R.

567. Endriga, B. G., and Valencia, I. G. AN EVALUATION OF ELECTRICAL RESISTANCE BLOCKS IN MEASURING SOIL MOISTURE. Philippine J. Soil Conserv. 2(1/2): 14-19. Ref. First and Second Q. 1957. 56.8 P53

A rapid method was evaluated for the calibration of electrical resistance units for the direct measurement of soil moisture. The method was basically that proposed by Omar Kelley and modified to suit local conditions in the Philippines. A clay soil and a clay loam soil, gypsum blocks, and nylon resistance units were used in the calibrations.

It was concluded that gypsum and nylon soil resistance units could be calibrated satisfactorily by the methods of Kelley, although at higher moisture contents, the methods gave variable results.

568. England, C. B. WATER USE BY SEVERAL CROPS IN A WEIGHING LYSIMETER. Agron. J. 55: 239-241. 1963. 4 Am34P

Results of 3-1/2 years' measurements of water use by various crops grown in a weighing lysimeter at Waynesville, N.C., were presented. A partial year's record under pasture, and 1 year's record under corn, oats, and alfalfa were compared.

569. Ente, P. J., and Glopper, J. De. SOIL SURVEYING IN AREAS OUTSIDE THE SEA-DIKES. (Du) Van Zee Tot Land. 36: 38-55. 1963. 54.8 V26.
English summary.

The special methods used for soil surveying in areas outside of the sea dikes in the Netherlands were given.

570. Epstein, E., Grant, W. J., and Hardesty, J. S. SOIL MOISTURE SURVEY OF SOME REPRESENTATIVE MAINE SOIL TYPES. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-57, 57 pp. 1962. A56.9 R 1

Information regarding the ability of soils to hold moisture that is available for plant growth is of importance to the farmer, irrigation and drainage engineer, and agricultural researcher. Recent increases in irrigation practices in the humid region have developed a greater interest in the determination of the available water. The data presented provide information on representative soil types that can be related to similar soils.

571. Erdos, L. EVAPORATION FROM BARE SOIL, MEASURED BY USING A LYSIMETER. (Hu) Idojaras. 68(4): 201-210. July/Aug. 1964. 340.8 Id5
English summary.

A description was given of a modified lysimeter used in Hungary. A short description was given of the results obtained over a two year period.

572. Erie, L. J. EVALUATION OF INFILTRATION MEASUREMENTS. Trans. ASAE 5: 11-13. 1962. 290.9 Am32T

Irrigation, tillage operations, rainfall, foliage, compaction, temperature, cracking of soils, erosion, and the shading action of plants are surface soil conditions affecting the rate water can enter the soil. Soil texture, sorting of particles, plow soles, bacterial action, root development, earthworms, and chemicals affect the movement of water through the soil mass where continuity must exist. Infiltration rates generally decrease as the soil or water will lower infiltration rates. High infiltration-rate soils are sensitive to changes in hydrostatic head, increasing with an increase in head. Infiltration rates generally decrease as the growing season advances. The temperature if the soil or eater is probably unimportant unless it is near the freezing range.

Cylinders used for measuring infiltration rates should be at least 6 inches in diameter. They should be constructed of no thicker than 12-gage metal. Cylinders should be driven straight into the soil with positive blows. The head of water within a cylinder should be similar to that expected under normal irrigation conditions and buffered with a similar head of water. When basins are used to determine infiltration rates, the expected irrigation head should be simulated and the downward movement of water measured.

573. Eriksson, E. THE CHEMICAL CLIMATE AND SALINE SOILS IN THE ARID ZONE. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 10: 147-180. maps. Ref. 1958. 278.9 Un3

The atmospheric transport of sea salts into arid regions to help form saline soils was discussed.

574. Evans, N. A. STRATUM SURVEY TECHNIQUES FOR DRAINAGE INVESTIGATION ON IRRIGATED LANDS. Colo. Agr. Expt. Sta. Tech. B. 67, 19 pp. Ref. Dec. 1958. 100 C71S

The techniques and equipment were briefly discussed that are used for making stratum surveys by three boring methods (auger, jetting, and modified jetting). The electrical resistivity method of survey was discussed in detail.

575. Fang, C. S., Ts'ai, W. K., and Wang, K. H. RESEARCH ON THE REPRESENTATIVE QUALITY METHOD FOR MEASURING SOIL MOISTURE. (Ch) Turang Tongbao. 2: 1-5. 1964. 56.8 T792

576. Fanning, C. D. DISTRIBUTION OF SOLUBLE SALTS IN A TYPICAL SALT SPOT OF THE LOWER RIO GRANDE VALLEY. Rio Grande Val. Hort. Soc. J. 16: 105-111. 1962. 81 L95

The soluble salt concentrations found in a typical salt spot of the Lower Rio Grande Valley changed rapidly over short distances. Highest concentrations were found to be associated with dense, slowly permeable subsoils. The preponderance of salts were the chlorides of calcium and sodium. Crystalline salts were observed in the subsoil of an exposed profile.

There was evidence that these salt-affected soils were the result of surface evaporation from a high water table.

577. Farnham, R. S. THE PEAT SOILS OF MINNESOTA. Minn. Farm and Home Sci. 14(2): 12-14, 19. Feb. 1957. 100 M668

The peat soils of Minnesota were described and classified.

578. Fatchikhina, O. E. IN REGARD TO METHODS OF STUDYING THE WATER PROPERTIES OF PEAT BOG SOILS. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 31: 167-176. Ref. 1955. 99.9 Ak1

579. Fehrenbacher, J. B., Wilding, L. P., Odell, R. T., and Melsted, S. W. CHARACTERISTICS OF SOLONETZIC SOILS IN ILLINOIS. Soil Sci. Soc. Amer. Proc. 27: 421-431. 1963. 56.9 So3

Solonetzic soils, commonly termed "slick-spots," occupy more than 381,000 acres on nearly level uplands in south-central Illinois and western Illinois. These loess-derived soils, high in exchangeable Na, occur as irregular-shaped areas varying in size from < 1 to > 100 acres. They are intimately associated with rather strongly developed planosolic soils.

Compared morphologically to associated Planosols, solonetzic soils have similar horizon sequences, but lighter colored surface horizons; thinner subsurface horizons; less well developed, columnar-prismatic B horizons; and contain carbonate concretions randomly distributed throughout their B horizons. The solonetzic soils have higher pH values and greater extractable (water-soluble plus exchangeable) Na regimes than associated soils.

In B horizons, solonetzic soils have pH values > 7.5 and extractable Na contents of 4 to 6 me. per 100 g., whereas associated soils usually have pH values < 6.5 and extractable Na contents < 1.0 me. per 100 g.

580. Feng, C. L., and Chen, L. I. SOIL MOISTURE PROBLEMS OF NORTH CHINA PLAIN AND ITS ASSOCIATED AREAS. I. THE MECHANISM OF MOISTURE DIFFUSION IN SOIL AND PROFILE IMPEDANCE TO MOVEMENT OF SOIL MOISTURE. (Ch) Acta Pedol. Sinica. 6(1): 1-24. Ref. 1958. 56.9 Ac8
English summary.

A discussion was given on soil moisture movement problems in North China.

581. Feng, K. S. MASS IMPROVEMENT AND UTILIZATION OF THE SALINE AND ALKALI SOIL AREA OF THE TIENTSIN AREA. (Ch) Nongye Jishu. 12: 2-4. Dec. 1962. 22.5 N929

582. Feodoroff, A. THE DRAINAGE OF SOIL WATER AND CAPACITY OF RETENTION. (Fr) Ann. Agron. 13(6): 523-547. 1962. 14 F8499
English summary.

From laboratory investigation in France, it was concluded that the capacity of water retention of a soil may be regarded as a dynamic notion, being the moisture content at the limits of two different regimes of moisture transfer. Two experimental procedures were given to determine the capacity of water retention of the soil in the laboratory.

583. Ferguson, A. H. MOVEMENT OF SOIL WATER AS INFERRED FROM MOISTURE CONTENT MEASUREMENTS BY GAMMA RAY ABSORPTION. Diss. Abs. 20(3): 814. 1959. 241.8 M58

An abstract was given on an attempt to measure the moisture content of soil by gamma ray absorption. The method was especially valuable in a study of water movement in nonhomogeneous soils in Washington.

584. Ferguson, H., Brown, P. L., and Dickey, D. D. WATER MOVEMENT AND LOSS UNDER FROZEN SOIL CONDITIONS. Soil Sci. Soc. Amer. Proc. 28(5): 700-703. 1964. 56.9 So3

Soil water and temperature distributions in a silty clay loam soil were studied in the field under freezing winter conditions. Appreciable upward water movement to a soil water was held at tensions of less than about 2 atm. and water held at tensions of less than 5 atm. moved toward the frozen zone contributed to overwinter water losses since soil water losses of 0.36 and 0.50 inches were measured from those plots in which there was appreciable upward water movement.

585. Fischbach, P. E., and Hoover, C. A. TENSIOMETERS FOR EFFICIENT IRRIGATION. Nebr. Expt. Sta. Q. 9(1): 17-19. Spring 1962. 100 N27N

A report was given on the use of tensiometers for soil moisture measurement in Nebraska.

586. Fisher, C. P. NEUTRON SCATTERING AND SOIL MOISTURE. Diss. (Abs.) 23(3): 967. Sept. 1962. 241.8 M58

An abstract was given on the use of the neutron scattering method for soil moisture measurement in North Carolina. The errors to be expected when using the various types of nuclear devices were compared to errors reported by others for tests using conventional techniques.

587. Flannery, R. D. LAND GROUPING FOR TREATMENT PROGRAM IN THE MIDDLE EAST. Internatl. Comn. Irrig. and Drain. Annu. B. 1961: 47-49, 75. Ref. 1961. 55.9 In8A

Land groupings based on reclamation requirements and subsurface drainage needs are useful for irrigation planning. These land groupings are also useful for irrigated areas that now have reclamation and drainage problems due to rising water tables and salinization.

588. Flannery, R. D., and Kirkham, D. A SOIL CORE WATER PERMEAMETER FOR FIELD USE. Soil Sci. 97(4): 233-241. 1964. 56.9 So3

A simple and easy-to-make field core permeameter equipment was described. The equipment was used to determine, for use in reclamation work, hydraulic conductivities of essentially undisturbed field soil. The equipment was easy to use and the formulas for reducting the permeameter data were very simple.

The equipment was applied to obtain vertical and horizontal hydraulic conductivities of a single soil layer as well as to obtain composite hydraulic conductivities of a number of layers. The cost of parts and assembly was low. A table of hydraulic conductivities and associated data was presented and discussed.

589. Fletcher, J. E. THE USE OF CAPACITANCE METHODS FOR DETERMINING QUANITIES OF MATERIALS IN MIXTURES. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 113-117. Ref. 1965. 291.9 In82

A report was given on the use of Capacitance Methods for measuring the amount of water in the soil and other types of moisture measurement.

590. Fly, C. L. THE SOIL DRAINABILITY FACTOR IN LAND CLASSIFICATION. J. Irrig. and Drain. Div. ASAE 87(IR3): 47-62. Ref. Sept. 1961. 290.9 Am3Ps

A drainability rating method, based on hydraulic conductivity of the soil and the depth to very slowly permeable or impervious strata, was developed and successfully used in a major project development in western Afghanistan. A tentative soil drainability guide for evaluating lands for irrigation use in the United States was presented.

591. Fox, W. E., and Page-Hanify, D. S. A METHOD OF DETERMINING BULK DENSITY OF SOIL. Soil Sci. 88: 168-171. 1959. 56.8 So3

Methods of determining bulk density were discussed and evaluated. The requirements of an accurage method of determination were stated. The design and use of an apparatus suitable for use on a soil free of stones were described. Results of a field test of the apparatus were given.

592. Fox, W. E., Page-Hanify, D. S., and Cullinane, R. E. SAMPLING FOR SOIL MOISTURE MEASUREMENTS. Austral. J. Expt. Agr. and Anim. Husb. 4(13): 191-192. May 1964. 23 Au792

An auger was described that was designed to use with a quick and efficient method of depth measurement for determining soil moisture measurements in Australia for the oven method.

593. Frazier, R. D., and Bertrand, A. R. AUTOMATIC RECORDING OF SOIL MOISTURE AND OTHER ECOLOGICAL FACTORS. Agron. J. 52(1): 53-54. Jan. 1960. 4 Am34P

An automatic recorder of soil moisture and other ecological factors was described.

594. Fujioka, Y., and Nishide, T. GLASS-FILTER ELECTRICAL MOISTURE BLOCK AND SELF-RECORDING MOISTURE METER FOR MEASURING SOIL MOISTURE. (Ja) Agr. Engin. Soc. (Japan) Trans. 9: 5-10. Oct. 1964. 290.9 Ag8
English summary.

A report was given on the use of a "glass-filter electrical resistance block" in Japan to measure soil moisture.

595. Garcia, F. G., Garcia, S. G., and Sanchez, M. C. THE ALKALI SOILS OF THE LOWER VALLEY OF THE GUADALQUIVER: PHYSICAL-CHEMICAL PROPERTIES AND NATURE OF THEIR CLAY FRACTION. Cong. Internatl. de la Sci. du Sol. Rap. 6(B, comn. I): 185-191. 1956. 56.09 In8452

A discussion was given on the physical properties, chemical properties, and nature of clay fraction of some alkali soils in Spain.

596. Gardner, W. H. WATER MOVEMENT IN SOIL. Plant Food Rev. 10(2): 8-11. Summer 1964. 57.8 P694

Water movement in soil was described and illustrated.

597. Gardner, W. R. DYNAMIC ASPECTS OF WATER AVAILABILITY TO PLANTS. Soil Sci. 89(2): 63-70. Feb. 1960. 56.8 So3

The flow equation was solved for the movement of water in soil to a plant root for an idealized geometry. The difference between the DPD in the plant root and the average soil suction necessary to maintain a given rate of uptake of water by the plant can be calculated and is proportional to the rate of water uptake and inversely proportional to the capilllary conductivity of the soil.

598. Gardner, W. R. MEASUREMENT OF CAPILLARY CONDUCTIVITY AND DIFFUSIVITY WITH A TENSIOMETER. Internatl. Soc. Soil Sci. Cong. Trans. 7(1): 300-305. 1960. 56.09 In847T

Three methods for the measurement of capillary conductivity and soil-water diffusivity with a tensiometer were described. In the first method, water is removed from the soil through the tensiometer cup at a constant rate and the time dependence of the suction in the cup is measured. In the second method, water is removed at a constant suction and the time dependence of the flux is measured. In the third method, a limited quantity of water is withdrawn at time $t = 0$ and the rate of return of the tensiometer manometer to equilibrium is recorded. The water content change of the soil is kept small so that solutions of the flow equation for constant conductivity can be used to calculate the conductivity. The diffusivity is calculated from the conductivity and the specific water capacity of the soil. Preliminary results agreed well with those obtained by other methods.

599. Gardner, W. R. WATER MOVEMENT AND AVAILABILITY TO PLANTS. Mededelingen van de Landbouwhogeschool, Ghent, Belgium. 26(2): 647-657. 1961. 105.1 G344

A discussion was given of a flow equation on the water movement in soils and its availability to plants.

600. Gardner, W. R., and Ehlig, C. F. THE INFLUENCE OF SOIL WATER ON TRANSPIRATION BY PLANTS. J. Geophysical Res. 68: 5719-5724. 1963. 470 J823

A relationship between transpiration and soil suction and soil-water content was derived. Good agreement between the theory and results of laboratory experiments was obtained. The results suggest that once plants wilt, the transpiration rate should be roughly proportional to the available water content of the soil. The lower limit of water available for transpiration occurred at a suction well above 15 bars.

601. Gardner, W. R., and Fireman, M. LABORATORY STUDIES OF EVAPORATION FROM SOIL COLUMNS IN THE PRESENCE OF A WATER TABLE. Soil Sci. 85: 244-249. 1958. 56.8 So3

The experimental rates of evaporation of water from laboratory soil columns was compared with the theoretical solutions of the steady-state unsaturated moisture-flow equation. Good agreement between theory and experiment was found. The evaporation rate was determined by climatic factors which controlled the external potential evaporation or by the maximum rate of upward movement of water in the soil, whichever was the lesser.

The evaporation rate was shown to be inversely proportional to the thickness of a surface mulch when the rate of vapor movement through the mulch was less than the potential evaporation.

602. Gardner, W. R., and Miklich, F. J. UNSATURATED CONDUCTIVITY AND DIFFUSIVITY MEASUREMENTS BY A CONSTANT FLUX METHOD. Soil Sci. 93(4): 271-274. Apr. 1962. 56.8 So3

A method for the measurement of soil-water diffusivity and conductivity was developed from the solution of the flow equation for constant flux of water at one boundary of a soil sample. Experiments showed the method to be feasible. Data for five soils were presented.

603. Garev, E. METHODS OF INVESTIGATING SOIL-WATER RELATIONSHIPS. Water Planning for Israel P.N. 288: 11-21. June 1962. 54 W29

A discussion was given of methods used to investigate soil-water relationships in Israel.

604. Gasser, J. K. R. INVESTIGATIONS ON RICE-GROWING IN BRITISH GUIANA: I. CHARACTERISTICS OF SOME RICE SOILS OF THE COASTLAND. J. Soil Sci. 12: 234-241. 1961. 56.8 J822

An attempt was made to account for the different soil types derived from alluvial material of similar age and origin. The sequence noted was undifferentiated alluvium (frontland clay soil), humose clay (pegassy-clay soil), thin organic soils (pegasse). The subsoil varied from that similar to frontland clay to a bleached yellowish-white structureless clay. Differing durations and intensities of flooding were considered to be responsible for the changes in the subsoil. With permanent flooding, plant residues accumulated on the surface and the soil was more rapidly leached. Less organic matter accumulated and less leaching occurred with seasonal flooding. Reefs of dry sand and other soils developed under special conditions and, as they did not belong to the general sequence, were described separately.

605. Gheorghe, S. THE ACCUMULATION OF SALTS IN THE PHREATIC WATERS AND SOILS OF THE LOWER DANUBE MEADOWLAND. (Rum) Prob. Agr. [Bucharest] 13(11): 27-36. Ref. Nov. 1961. 21 R862
French summary.

606. Gheorghiu, I. M., Gogalniceanu, S., and Galben, T. COMPARATIVE STUDY OF THE METHODS OF DETERMINATION OF WATER IN SOIL AND ESTABLISHMENT OF CONDITIONS FOR ITS UTILIZATION IN FIELDS. (Rum) Bucharest. Inst. Agron. "N. Balcescu." Lucrari Sti. Ser. B., 7: 267-276. 1964. 106.4 B854B
French summary.

607. Gile, L. H. FRAGIPAN AND WATER-TABLE RELATIONSHIPS OF SOME BROWN PODZOLIC AND LOW HUMIC-GLEY SOILS. Soil Sci. Soc. Amer. Proc. 22(6): 560-565. Nov./Dec. 1958. 56.9 So3

Profile descriptions and chemical data were given for some Brown Podzolic and Low Humic-Gley Soils in New Hampshire along with water-table relationships.

608. Gile, L. H. A CLASSIFICATION OF CA HORIZONS IN SOILS OF A DESERT REGION, DONA ANA COUNTY, NEW MEXICO. Soil Sci. Soc. Amer. Proc. 25: 52-61. 1961. 56.9 So3

A study was reported on the classification of calcium horizons in soils of a desert region in New Mexico. CA horizons were classified as weak, moderate, strong, and very strong. The classification was based on field morphology and pertinent laboratory data, including $CaCO_3$ equivalent, particle size distribution, bulk density, unconfined compressive strength, and infiltration rate.

609. Girbutchev, I., and Petkov, P. A STUDY ON THE STRUCTURE AND LEAKING PROPERTIES OF THE SOIL OF THE STATE AGRICULTURAL SCIENTIFIC AND RESEARCH INSTITUTE "V. Tchervenkov." (Bu) Bulgar. Min. na Zemedel. Nauch.-Izsled. Inst. Sborn. Nauch. Trudove. 3: 43-56. Ref. 1956. 21 B877
English summary.

A study was reported on the physical properties of the soil at the "V. Tchervenkov" Research Institute in Bulgaria.

610. Girshkan, S. A. STUDY OF THE DYNAMICS OF SEEPAGE FLOW BY MEANS OF NEUTRON MOISTURE METER. (Rus) Gidrotekh. i Melior. 9: 26-33. Sept. 1964. 290.8 G362

611. Gomes, M. P., Silva, A. A. D., and Franca, L. D. A STUDY ON THE CAPILLARY RISE OF WATER AND ITS APPLICATION TO SOILS. Portugal. Missao de Estudos Agron. do Ultramar. Estudos Agron. 2(3): 109-121. Ref. 1961. 56.9 P83

A study in Portugal was described of the capillary rise of water and its application to soils.

612. Gorham, E. THE DEVELOPMENT OF PEAT LANDS. Q. Rev. Biol. 32(2): 145-166. Ref. June 1957. 442.8 Q2

An account of bog development and peat accumulation was given as it occurs in Great Britian. A discussion of some chemical aspects of bog ecology and a general view of some ways in which the major ecological factors may influence the bog development in various parts of the world were included.

613. Gorodetskii, L. N. ORIGIN OF MEADOW SOILS AND PEAT ON THE GANDZHA INTER-MOUNTAIN PLAIN. (Rus) In Azerbaijan Ministerstvo Sel'skogo Khoziaistva. SBORNIK MATERIALOV PO KHLOPKOVODSTVU. Baku, Azerbaidzhanskow Gosudarstvennoe Izdatel'stvo, pp. 187-190. Ref. 1956. 72 Az2

614. Gradwell, M. W. AN EXAMINATION OF THE SURFACE-ACTIVE AGENT PR 51 AS AN ACCELERATOR OF DRAINAGE FROM PASTURE TOPSOILS. New Zeal. J. Agr. Res. 1(6): 834-840. Dec. 1958. 23 N4892

The surfactant PR 51 produced measurable acceleration of the drainage for some New Zealand soils, both by a faster rate of discharge and by more rapid reduction of moisture content of the soil after the surface water had disappeared. In this experiment, the improvements were too small to be of practical use in draining wet pastures.

615. Greenland, D. J. A LYSIMETER FOR NITROGEN BALANCE STUDIES IN TROPICAL SOIL. West African Sci. Assoc. J. 5(1): 79-89. Feb. 1959. 515 W52

A report was given on the construction and use of a lysimeter to study nitrogen balance in tropical soils in Ghana.

616. Gubarev, A. N. DEVICE FOR DETERMINATION OF SOIL MOISTURE UNDER FIELD CONDITIONS. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 48: 233-238. 1962. 106 P44
English summary.

A new portable device used in U.S.S.R. for determining soil moisture in the field was described.

617. Gupta, R. P., and Staple, W. J. INFILTRATION INTO VERTICAL COLUMNS OF SOIL UNDER A SMALL POSITIVE HEAD. Soil Sci. Soc. Amer. Proc. 28(6): 729-732. 1964. 56.9 So3

Experimentally measured soil moisture profiles during infiltration into vertical columns of air-dry Grenville silt loam, under a small positive hydrostatic pressure, were compared with those predicted by the iterative procedure of Philip, and by an explicit finite difference method.

618. Gurr, C. G. USE OF GAMMA RAYS IN MEASURING WATER CONTENT AND PERMEABILITY IN UNSATURATED COLUMNS OF SOIL. Soil Sci. 94(4): 224-229. Oct. 1962. 56.8 So3

A report was described on the use of gamma rays to measure water content in columns of unsaturated soil.

619. Gurr, C. G. CALCULATION OF SOIL WATER CONTENTS FROM GAMMA RAY READINGS. Austral. J. Soil Res. 2(1): 29-32. June 1964. 56.8 Au7

A report was given on the calculation of soil water content from gamma ray readings in Australia. A nomogram was constructed to aid in the calculation of results.

620. Gurr, C. G., and Marshall, T. J. UNSATURATED PERMEABILITY—ITS MEASUREMENT AND ITS ESTIMATION FROM OTHER PROPERTIES OF THE MATERIAL. Internatl. Cong. Soil Sci. Trans. 7(I): 306-310. 1960. 56.09 In847T

A method was described of measuring in a soil column the water content profile, the rate of water movement and the suction gradient for both steady and non-steady state water movements caused by evaporation at the surface of the column. Water contents are measured by the absorption of a narrow gamma ray beam passing through the column, and soil water suction by tensiometers.

From the data obtained, the permeability of the soil to water as a function of water content or suction is obtained, and the relation between soil water content and suction established from which permeability values may be calculated and compared with the measured permeability values.

621. Gyurov, G. THE MOOR SOILS AND THE ALLUVIAL MEADOW SOILS IN DISTRICTS ON THE RIGHT BANK OF THE MARITZA THAT HAVE BEEN SALTED. (Bu) Vissh Seldkostopanski Inst. "Vasil Kolarov." Nauch. Trudove. 13(1): 213-221. 1964. 106.3 P72
German summary.

622. Haahr, V. THE USE OF RADIOISOTOPES FOR SOIL PHYSICAL MEASUREMENTS. THE NEUTRON SCATTERING METHOD FOR MEASURING SOIL MOISTURE. (Sw) Grundforbattring. 16(4): 295-313. Ref. 1963. 54.8 G92
English summary.

A report was given for the use of radioisotopes in Sweden for soil physical measurement by the use of the neutron scattering method for measuring soil moisture.

623. Haans, J. C. F. M. AVAILABLE MOISTURE IN SOILS OF THE NETHERLANDS. Cent. Organ. v. Toegepast-Natwetensch. Onderz. Verslagen van de Tech. Bijeenkomsten. 13/14: 140-160. 1957/58, pub. 1960. 292.9 C33

A discussion was given on the available moisture in various soils of the Netherlands.

624. Haise, H. R. HOW TO MEASURE THE MOISTURE IN SOIL. U.S. Dept. Agr. Ybk. 1955: 362-371. 1955. 1 Ag84Y

Two factors are involved in measuring day-to-day changes in soil water—the amount of water per unit mass or volume of soil, or percentage of moisture; and the energy or force with which water is retained. Different methods of measuring soil moisture were discussed.

625. Haise, H. R., Donnan, W. W., Phelan, J. T., Lawhon, L. F., and Shockley, D. G. THE USE OF CYLINDER INFILTROMETERS TO DETERMINE THE INTAKE CHARACTERISTICS OF IRRIGATED SOILS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-7, 10 pp. May 1956. A56.9 R31

Cylinder infiltrometers that have been found suitable for use in determining the intake characteristics of irrigated soils were described and illustrated. A standardized use of equipment and procedures are needed so that results can be correlated between different field personnel.

626. Hakansson, A. THE PHYSICAL CONDITIONS OF THE SOIL AND THE WATER FACTOR. (Sw) In GODSLINGENS PLANLAGGNING. Stockholm, Godsel- och Kalk-industriernas Samarbetsdelegation, pp. 22-26. 1960. 57.9 G54

627. Halevy, E., and Nir, A. USE OF RADIOISOTOPES IN STUDIES OF GROUNDWATER FLOW. II. THE CHARACTERISTICS OF TRACER PULSE SHAPE. Internatl. Conf. Peaceful Uses Atomic Energy Proc. 2(20): 162-165. 1958. 334.9 In83

A report was given on the characteristics of tracer pulse shape in a study of the use of radioisotopes to study ground water flow in Israel.

628. Halevy, E., Nir, A., Harpaz, Y., and Mandel, S. USE OF RADIOISOTOPES IN STUDIES OF GROUNDWATER FLOW. I. LABORATORY AND FIELD EXPERIMENTS ON THE SUITABILITY OF VARIOUS TRACERS. Internatl. Conf. Peaceful Uses Atomic Energy Proc. 2(20): 158-161. 1958. 334.9 In83

Laboratory and field experiments were described on the suitability of various radioisotopes tracers to study ground water flow in Israel.

629. Hanks, R. J., and Harkness, K. A. SOIL PENETROMETER EMPLOYS STRAIN GAGES. Agr. Engin. 37(8): 353-354. Aug. 1956. 58.8 Ag83

By replacing the penetrometer probe, in the apparatus used by Richards, with a rod bored to fit over the 3/8-inch steel ball of the sample breaking machine, the penetrometer was used successfully to measure the modulus of rupture of soil.

630. Hansen, V. E. INFILTRATION AND SOIL WATER MOVEMENT DURING IRRIGATION. Soil Sci. 79: 93-105. 1955. 56.8 So3

There are three basic parts to the phenomena of water movement during irrigation—transmission zone, wetting zone, and wetting front. The transmission zone is characterized by an essentially constant hydraulic conductivity and approximately 80-percent saturation.

The wetting zone extends from the transmission zone to the wetting front, and the hydraulic conductivity and degree of saturation both are reduced as the wetting front is approached.

The wetting front is the foremost point of advance of the moving water. The movement of the wetting front becomes more and more erratic as the initial moisture content is reduced. In the drier soils the wetting front advances in a "jumping" motion. Rate of entry in moist soils is less than in drier soils. The wetting front advances more rapidly when the soil is wet.

631. Hardman, R. L., Van Buren, W., and Magee, R. A. USE OF SOIL MOISTURE MEASURING EQUIPMENT. Oreg. State Hort. Soc. Annu. Rpt. 49: 172. 1957. 81 Or32

A panel discussion was given on the use of soil moisture measuring equipment for horticultural crops.

632. Hardy, M. LYSIMETRIC EXPERIMENTS AND PROSPECTS FOR OVERHEAD IRRIGATION. (Fr) Rev. Agr. et Sucr. de l'Ile Maurice. 43(3): 216-218. July/Sept. 1964. 24 M44

633. Harris, S. A. SALINE SOILS IN THE KIRKUK PLAIN, NORTHERN IRAQ. J. Soil Sci. 11(1): 114-130. Ref. Mar. 1960. 56.8 J823

A report was given on the genesis and classification of some saline soils in Iraq. The effect of drainage deficiency in irrigated areas and the use of too little irrigation water to remove salt was listed as some reasons for the present salinity.

634. Harris, W. F. SOIL DEVELOPMENT ON PEAT. New Zeal. Soc. Soil Sci. Proc. 2: 25-27. 1956. 56.09 N48

The effect of drainage on a peat bog was studied in New Zealand.

635. Harrold, L. L. LYSIMETER CHECKS ON EMPIRICAL EVAPOTRANSPIRATION VALUES. Agr. Engin. 39(2): 94-97. Ref. Feb. 1958. 58.8 Ag83

A report was given on the use of lysimeters to check on empirical evapotranspiration values.

636. Harrold, L. L., and Dreibelbis, F. R. EVALUATION OF AGRICULTURAL HYDROLOGY BY MONOLITH LYSIMETERS 1944-55. U.S. Dept. Agr. Tech. B. 1179, 166 pp. map. Ref. Aug. 1958. 1 Ag84Te

An evaluation was given of various important factors of agricultural hydrology over a period of 12 years (1944-55) by the Coshocton monolith lysimeters.

637. Harrold, L. L., and Dreibelbis, F. R. WEIGHING MONOLITH LYSIMETERS AND EVALUATION OF AGRICULTURAL HYDROLOGY. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 105-115. 1959. 292.9 As7C

A brief description was given on the major features of Coshocton weighing lysimeters and some details on data tabulation, computation, and compilation.

638. Harrold, L. L., and Dreibelbis, F. R. ERRORS IN EVALUATIONS OF DEW AMOUNTS BY THE COSHOCTON LYSIMETER. Internatl. J. Hydrol. 2(3): 73. 1962.

A report was given on the errors in evaluation of dew amounts by the Coshocton lysimeters.

639. Harrold, L. L., and Dreibelbis, F. R. EVIDENCE OF ERRORS IN EVALUATION OF DEW AMOUNTS BY THE COSHOCTON LYSIMETERS. Internatl. Assoc. Sci. Hydrol. 65: 425-431. 1963. 292.9 As7

A report was given on the evidence of errors in evaluation of dew amounts by the Coshocton lysimeters.

640. Harrold, L. L., Peters, D. C., Dreibelbis, F. R., and McGuinness, J. L. TRANSPIRATION EVALUATION OF CORN GROWN ON A PLASTIC-COVERED LYSIMETER. Soil Sci. Soc. Amer. Proc. 23(2): 174-178. 1959. 56.9 So3

Corn grown on plastic-covered monolith lysimeters at Coshocton showed that a very good crop was produced using only the water stored in the soil. A yield of 125 bushels per acre was obtained by using only 8.5 inches of water from the soil.

641. Hasebe, J. DETERMINATION OF SOIL MOISTURE WITH AN EXPERIMENTAL TENSIOMETER. (Ja) Nogyo Gijutsu. 18(9): 18-21. Sept. 1963. 22.5 N6829

642. Haskell, C. C., and Hawkins, R. H. D_2O-Na^{24} METHOD FOR TRACING SOIL MOISTURE MOVEMENT IN THE FIELD. Soil Sci. Soc. Amer. Proc. 28(6): 725-728. Ref. Nov./Dec. 1964. 56.9 So3

A unique method was described for measuring unsaturated flow of water in the field with D_2O tracer, a Na-24 gamma source, and a slow-neutron detector. The Na-24 gamma source and the slow-neutron detector was contained in a modified neutron-type soil moisture probe.

643. Haskell, E. E., Jr., and Bianchi, W. C. FIXED-POSITION DEVICE FOR SAMPLING SOIL SOLUTION IN DEPTH. Amer. Water Works Assoc. J. 56(5): 664-666. May 1964. 292.9 Am32J

A fixed-position device for sampling soil solution in depth was described and illustrated.

644. Hauser, V. L. PARAFFIN STANDARDS FOR NEUTRON METER CALIBRATION. Agr. Engin. 43(2): 88-89. Feb. 1962. 58.8 Ag83

Paraffin standards were described and illustrated that can be used for faster calibration of the neutron meter used for soil moisture measurement.

645. Haushofer, H. THE INVENTION OF THE LYSIMETER. (Ge) Z. f. Agrargesch. u. Agrarsoziol. 10(1): 57-60. Apr. 1962. 30.98 Z3

646. Hayes, M. H. B. SUBSIDENCE AND HUMIFICATION IN PEATS. I-II. Diss. Abs. 21(4): 759. Oct. 1960. 241.8 M58

A shallow muck soil was analyzed and classified in Ohio. The contribution of the oxidation and solubilization action processes to subsidence was studied by using soil columns.

647. Hayes, M. H. B., and Mortensen, J. L. CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF RIFLE PEAT PROFILES. Ohio Agr. Expt. Sta. Res. C. 123, 11 pp. 1963. 100 Oh3R

Three distinct organic layers were observed in profiles of cultivated and virgin organic soil classified as Rifle peat. The plow layer had properties characteristic of muck, the intermediate layer was composed of dark-down, stratified fibrous material, and the basal layer was sticky, structureless, black in color, and probably contained gyttja or organic matter leached from surface layers and deposited on the mineral substratum.

Cation exchange capacity, DTA thermograms, electrophoretic mobility, calorific value, pyrophosphate solubility, and carbon-nitrogen ratios indicated that most of the organic matter throughout the profiles could be classified as muck.

648. Hesse, W. NEW METHODS OF DETERMINATION OF SOIL MOISTURE AND EVAPORATION. (Ge) Wroclaw. Wyzsza Szkola Roln. Zeszyty Nauk. Melior. 7: 125-129. 1962. 54.9 B75

649. Heinselman, M. L. FOREST SITES, BOG PROCESSES, AND PEATLAND TYPES IN THE GLACIAL LAKE AGASSIZ REGION, MINNESOTA. Ecol. Monog. 33: 327-374. 1963. 410 Ec72

Two related ecological projects concerned with forest sites and bog processes on the Lake Agassiz peatlands of northern Minnesota were conducted between 1955-61.

Black spruce sites in the Lindford Peatland, located in Koochiching County were studied. Factors investigated included bog topography, ground water levels, water movement, peat characteristics, peat depth, distance from margins, substrata, soil temperatures, and soil freezing. Site index was the dependent variable. The physiography, peat stratigraphy, and vegetation of the area were interpreted in terms of results.

A study of bog processes and peatland types within Lake Agassiz was conducted as a survey of peat stratigraphy, physiography, and vegetation in key areas with pronounced vegetation patterns. Widespread evidence of bog expansion, rising water tables, and site deterioration was found. Myrtle Lake, one of few bog lakes, seems to have risen some 14 feet with peat accumulation.

650. Hendricks, S. B. SALT TRANSPORT ACROSS CELL MEMBRANES. Amer. Sci. 52(3): 306-333. Sept. 1964. 470 Si2

A discussion was given on salt transport across cell membranes.

651. Heuveln, B. van., Jongerius, A., and Pons, L. J. SOIL FORMATION IN ORGANIC SOILS. Internatl. Cong. Soil Sci. Trans. 7(IV): 195-204. 1960. 56.09 In847T

When peat is submitted to drainage pedogenetic processes occur. These processes are: Physical ripening, disintegration, molding, leaching and accumulation.

By drainage and by roots peat looses water irreversibly. This causes a reduction of the peat mass and increasing of the water storing capacity.

652. Hewlett, J. D., Douglass, J. E., and Clutter, J. L. INSTRUMENTAL AND SOIL MOISTURE VARIANCE USING THE NEUTRON-SCATTERING METHOD. Soil Sci. 97(1): 19-24. Jan. 1964. 56.8 So3

The variation of soil moisture estimates determined by the neutron scattering method was examined in theory and related to field data from two research areas. A standard model was developed to account for error.

653. Hill, D. E. THE STORAGE OF MOISTURE IN CONNECTICUT SOILS. Conn. Agr. Expt. Sta. B. 627, 30 pp. 1959. 100 C76St

The ability of soils to store moisture and release it for the use of growing plants is a primary determinant of the agricultural value of land. A survey of the storage abilities of Connecticut soils was described. This knowledge is especially useful in irrigation practices.

654. Hitake, Y., and Koga, T. CHARACTERISTICS OF THE POLDER SOILS DEVELOPED ALONG THE COAST OF YATSUSHIRO BAY. (Ja) Kyushu Agr. Res. 1956(18): 1-5. Oct. 1956. 107.6 K996

655. Ho, C., and Chen, C. F. ON THE PROPERTIES OF THE MICRO-AGGREGATES OF PADDY SOILS DERIVED FROM QUATERNARY RED CLAY. (Ch) Acta Pedol. Sinica. 12(1): 55-62. Ref. Mar. 1964. 56.9 Ac8
English summary.

Physical and chemical properties were described of micro-aggregates of paddy soil from Quaternary red clay in China.

656. Hobbs, J. A., and Wittsell, L. E. MECHANICS OF WATER MOVEMENT AND STORAGE IN SOILS: A TEACHING TECHNIQUE. Agron. J. 55(1): 67-70. Jan./Feb. 1963. 4 Am34P

Water movement and water storage were described for a tank equipped with a porous cover and three storage sections. Either graphic methods or intergration can be used to determine how the velocity of water flow and the rate of water storage or loss change with time.

657. Holmes, J. W. MEASURING SOIL WATER CONTENT AND EVAPORATION BY THE NEUTRON SCATTERING METHOD. Netherlands J. Agr. Sci. 4: 30-34. Ref. Feb. 1956. 12 N3892

The neutron scattering method was used near Adelaide, South Australia, to measure soil water content values in the field with fair success. The size of the sample volume, scanned by the neutrons, limited its value at shallow depths. The diameter of the probe also influenced the sample volume.

658. Holmes, J. W. CALIBRATION AND FIELD USE OF THE NEUTRON SCATTERING METHOD OF MEASURING SOIL WATER CONTENT. Austral. J. Appl. Sci. 7: 45-58. Mar. 1956. 475 Au74

The calibration and field use of the neutron scattering method for measuring soil water content was discussed for Australia.

659. Holmes, J. W. ASPECTS OF SOIL MOISTURE MEASUREMENT WITH REFERENCE TO ARID SOILS. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 11: 295-300. Ref. 1958. 278.9 Un3

A report was given on the aspects of soil moisture measurement for arid soils.

660. Holmes, J. W., and Jenkinson, A. F. TECHNIQUES FOR USING THE NEUTRON MOISTURE METER. J. Agr. Engin. Res. 4(2): 100-109. Ref. 1959. 58.8 J82

Techniques used in England for using the neutron moisture meter were given.

661. Holmes, J. W., and Turner, K. G. THE MEASUREMENT OF WATER CONTENT OF SOILS BY NEUTRON SCATTERING: A PORTABLE APPARATUS FOR FIELD USE. J. Agr. Engin. Res. 3(3): 199-204. 1958. 58.8 J82

A portable neutron soil meter used in England for field use was described and illustrated. The calibration curve with respect to soil water content was approximately linear.

662. Holmes, R. M. NOTE ON HOT WATER BOTTLE LYSIMETER. Canad. J. Soil Sci. 43(1): 186-188. Feb. 1963. 56.8 C162

A small hot water bottle lysimeter used in Canada was described and illustrated.

663. Holt, R. F., Blake, G. R., Voorhees, W. B., Boelter, D. H., and Robertson, A. S. SOIL MOISTURE SURVEY OF SOME REPRESENTATIVE MINNESOTA SOILS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-48, 43 pp. 1961. A56.9 R31

As an aid to understanding soil moisture conservation needs in Minnesota, a survey of the water holding characteristics of some major soil types was made. Nineteen soils were studied. These soils were listed according to sample number, soil type, location, soil group, and total and available inches of water to 5 feet in the table.

Soil profile descriptions for each soil investigated, together with moisture release data, particle size distribution, bulk density and total and available inches of water, appeared in tabular form at the end of the introductory text.

664. Holtan, H. N. A CONCEPT FOR INFILTRATION ESTIMATES IN WATERSHED ENGINEERING. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-51, 25 pp. Oct. 1961. A56.9 So3

A system of estimating infiltration based upon soil porosity and its availability for storage as affected by vegetation and soil moisture was proposed. An example of the system using data taken from two small water sheds in Illinois was given.

665. Hore, F. R. PIEZOMETER METHOD IN ONTARIO. Agr. Engin. 40(5): 272-273. May 1959. 58.8 Ag83

A discussion was given on some irregularities of the measurement of hydraulic conductivity on some non-uniform soil conditions on a Brookston clay loam soil near Chatham, Ontario for the design of drainage systems.

666. Horn, M. E., Rutledge, E. M., Dean, E. H., and Lawson, M. CLASSIFICATION AND GENESIS OF SOME SOLONETZ (SODIC) SOILS IN EASTERN ARKANSAS. Soil Sci. Soc. Amer. Proc. 28(5): 688-692. map. Ref. Sept./Oct. 1964. 56.9 So3

The genesis and classification were reported for some solonetz (sodic) soils in eastern Arkansas.

667. Hsi, C. F. TYPES OF SALINE SOILS IN SHANSI PROVINCE AND MEASURES FOR THEIR AMELIORATION. (Ch) Acta Pedol. Sinica. 12(4): 401-410. Dec. 1964. 56.9 Ac8
English summary.

A report was given on the types of saline soils in Shansi province in Japan and methods for their amelioration by soil management.

668. Hsi, C. F., and Chao, C. FORMATION, SODA ACCUMULATION AND ALKALIZATION OF SALINE SOILS IN TATUNG BASIN. (Ch) Acta Pedol. Sinica. 10(3/4): 235-257. Sept./Dec. 1962. 56.9 Ac8
English summary.

The formation, management, and amelioration of saline soils in China were discussed.

669. Hudig, J. THE OCCURRENCE, ORIGIN AND PROPERTIES OF BIOGENIC CLAYS IN THE LOW MOORS OF THE NETHERLANDS. (Ge) Z. f. Pflanzenernahr. Dungung, Bodenk. 105(3): 212-223. Ref. June 1964. 384 Z343A
English summary, pp. XIII

A review of the literature was given on the occurrence, origin, and properties of biogenic clays in the low moors of the Netherlands.

670. Hudig, J., Marel, H. W. Van Der., and Beutelspacher, H. THE IDENTIFICATION AND FORMATION OF CLAY MINERALS IN LOW MOOR SOILS OF THE NETHERLANDS. (Ge) Z. F. Pflanzenernahr. Dungung, Bodenk. 105(3): 224-239. Ref. June 1964. 384 Z343A
English summary, pp. XIII

X-ray and electron microscope studies were reported on the identification and formation of clay minerals in low moor soils of the Netherlands.

671. Hudson, J. C. AGRICULTURE MOISTURE STUDIES IN BARBADOS, USING TWO TYPES OF LYSIMETERS. Barbados. Min. Agr. Lands Fish. B. 34, 25 pp. Dec. 1963. 8 B23B

A report was given on the design and use of two lysimeters for moisture studies in Barbados, British West Indies.

672. Huet, J. FIELD DETERMINATION OF MOISTURE AND DENSITY IN SOILS BY THE NUCLEAR METHODS. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 185-193. 1965. 291.9 In82

A report was given on the experimental determination of moisture content and density of soils using surface and depth radioactive equipment in Belgium.

673. Iizuka, J., and Seo, H. SOIL SURVEY REPORT OF THE PEAT LAND IN THE PROVINCE OF TESHIO HOKKAIDO. II. THE SOUTHERN PART OF THE PROVINCE. (Ja) Hokkaido Natl. Agr. Expt. Sta. Soil Survey Rpt. 14, 142 pp. map. Mar. 1964. 56.9 H68

674. Ikeda, M., and Harada, I. STUDIES OF SOILS IN THE TRANSFERRING CULTIVATION AND UPLAND PADDY FIELDS. Cong. Internatl. de la Sci. du Sol. Rap. 6(C, colloque du Riz): 507-513. 1956. 56.09 In8452

A report was given on the improved physical properties of soils where a rotation of upland cultivated crops plus rice paddy was compared with continuous paddy fields in Japan.

675. Il'kun, G. M. MOISTURE EXCHANGE BETWEEN SAND AND PEAT. (Uk) Akad. Nauk Ukrain. RSR. Dopovidi. 1: 88-90. 1956. 511 K54
Russian summary.

676. Ineson, J., and Gray, D. A. ELECTRICAL INVESTIGATIONS OF BOREHOLE FLUIDS. J. Hydrol. 1(3): 204-218. 1963. 292.8 J82

Borehole investigations were described in which electrical measurements of the borehole fluids were interpreted in terms of their salinity, to assist in the solving of ground-water problems.

677. Isozaki, H., and Shimada, Y. ON THE MODERATE PERCOLATION QUANTITY OF PADDY FIELDS. III. (Ja) Nogyodoboku-Kenkyu. 27(4): 180-185. Oct. 1959. 290.8 N68
English summary.

A report was given on a lysimeter study in Japan on the percolation through paddy fields.

678. Ivanova, E. N. TENATIVE CLASSIFICATION OF STEPPE SOLONETZES. (Rus) Pochvovedenie. 3: 14-26. Ref. Mar. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 3: 214-223. Ref. Mar. 1963. 57.8 P34Ae

A classification system was given for steppe solonetz soils in the U.S.S.R.

679. Jackson, R. D. WATER VAPOR DIFFUSION IN RELATIVELY DRY SOIL. I. THEORETICAL CONSIDERATIONS AND SORPTION EXPERIMENTS. Soil Sci. Soc. Amer. Proc. 28(2): 172-176. 1964. 56.9 So3

Water transfer was measured in three soil materials at water content ranges corresponding to a relative pressure range of 0.97 to about 0.05. At these water contents vapor flow was probably the predominant transfer mechanism. The data were obtained from a transient sorption experiment and diffusion coefficients were calculated from analyses of water content distribution curves. The evaporation-condensation reaction between the liquid and vapor phases was treated by using simultaneous diffusion-reaction theory. Within the water content ranges used, the diffusion coefficients increased and then decreased with increased water content.

680. Jackson, R. D., Nielsen, D. R., and Nakayama, F. S. ON DIFFUSION LAWS APPLIED TO POROUS MATERIALS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-86, 11 pp. Nov. 1963. A56.9 R31

A discussion was given on diffusion laws applied to porous materials.

681. Jackson, R. D., Van Bavel, C. H. M., and Reginato, R. J. EXAMINATION OF THE PRESSURE-PLATE OUTFLOW METHOD FOR MEASURING CAPILLARY CONDUCTIVITY. Soil Sci. 96(4): 249-256. Oct. 1963. 56.8 So3

An examination was reported on the use of the pressure-plate outflow method for measuring capillary conductivity.

682. Jamison, V. C. WATER MOVEMENT RESTRICTION BY PLANT RESIDUES IN A SILT LOAM SOIL. Internatl. Soc. Soil Sci. Cong. Trans. 7(1): 464-472. 1960. 56.09 In847T

Soil models were used to study the transmission of moisture across barriers formed by turning under plant residues. After a heavy application of water, the air-filled porosity of Mexico silt loam was very low only a short time where the surface was initially loose. If compacted to 1.3 g./cc. the time was increased. The presence of a shredded cornstalk barrier further increased the time of low air content. Hydraulic gradients in the contact zone between surface and subsoil was usually greater than in the soil body. This was increased by plant residues severing contact. Moderate compaction of the soil surface reduced flow across the barrier at low suctions. The average reduction in conductivity across the boundary by a trash barrier was much greater at high than at low suctions.

683. Jamison, V. C., and Kroth, E. M. AVAILABLE MOISTURE STORAGE CAPACITY IN RELATION TO TEXTURAL COMPOSITION AND ORGANIC MATTER CONTENT OF SEVERAL MISSOURI SOILS. Soil Sci. Soc. Amer. Proc. 22: 189-192. 1958. 56.9 So3

Fifty-four profiles of twenty-one "predominately silty" Missouri soils were studied. Undisturbed cores were taken with modified Lutz Samples for suction, bulk density, and field moisture measurements. Available moisture holding capacity, organic matter content, and mechanical composition were determined. These studies showed that for these dominantly silty soils available moisture storage capacity (A.W.C.) decreased with clay and increased with silt content.

684. Jamison, V. C., and Thornton, J. F. WATER INTAKE RATES OF SHELBY-GRUNDY SOILS FROM HYDROGRAPH ANALYSIS. Trans. ASAE 2(1): 92-94. 1959. 290.9 Am32T

The hydrograph analysis method was used to show the water intake rates of Shelby-Grundy soils from rainfall runoff records collected at Bethany, Mo. from 1933-42. Method of analysis and a discussion of results were given.

685. Jamison, V. C., and Thornto-, J. F. WATER INTAKE RATES OF A CLAYPAN SOIL FROM HYDROGRAPH ANALYSES. J. Geophys. Res. 66(6): 1855-1860. June 1961. 470 J823

The hydrographic analyses of rainfall-runoff data from storms occurring during the period 1945-57 were used to estimate soil intake rates and rainfall retention. The intake rates varied from more than 2 inches to less than .01 inch per hour, depending mostly upon antecedent soil moisture and duration of the storms.

686. Janse, A. R. P., and Bolt, G. H. THE DETERMINATION OF THE AIR-PERMEABILITY OF SOILS. Netherlands J. Agr. Sci. 8: 124-136. 1960. 12 N3826

An improved apparatus for the determination of the air-permeability of soils at constant pressure gradient was described. The merits of this apparatus were discussed. Some experimental results obtained with a sandy soil under different tillage conditions were given as an example of the application of this determination.

687. Jarvela, H. A. EVALUATION OF THE ACCURACY OF SOIL MOISTURE DETERMINATION WITH THE NEUTRON METHOD. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 87: 111-118. 1963. 20 M857

688. Jasnowski, M. HIGH PEAT-BOGS IN THE ODRA RIVER VALLEY AT ITS ESTUARY TO THE SZCZECIN BAY. (Pol) Zeszyty Prob. Postepow Nauk Roln. 25: 99-124. maps. Ref. 1960. 20.5 Z5 English summary.

A report was given on the genesis of some high peat-bogs in the Odra River valley of Poland.

689. Johnston, W. R., Letey, J., and Pillsbury, A. F. HYDRAULIC CONDUCTIVITY VALUES COMPARED USING (1) PONDED WATER THEORY AND (2) AN AUGER HOLE METHOD. Trans. ASAE 6(3): 249-250. 1963. 290.9 Am32T

Hydraulic conductivity values were measured by the auger hole method in Colorado and compared with those calculated using Kirkham's ponded water theory on existing drainage system. On fairly uniform textured alluvial soils, the auger hole hydraulic conductivity values compared favorably with those calculated.

690. Johnston, W. R., and Perrier, E. R. USE OF DIRECT- AND ALTERNATING-CURRENT METERS FOR MEASURING RESISTANCE OF SOIL-MOISTURE UNITS. Soil Sci. 91(6): 360-363. Ref. June 1961. 56.8 So3

An experiment was conducted to compare the use of a.c. and d.c. meters in determining resistance of electrical resistance units for measuring soil moisture "in situ". The results indicated that the d.c. meters could be used satisfactorily provided care was taken to minimize the effects of electrolysis and polarization.

691. Jordan, J. V., Lewis, G. C., and Fosberg, M. A. TRACING MOISTURE MOVEMENT IN SLICK-SPOT SOILS WITH RADIOSULFUR. I. Amer. Geophys. Union Trans. 39: 446-450. 1958. 330.9 Am3

Preliminary greenhouse tests using slick-spot soil and associated soil in columns indicated that cobalt and sulfur moved through the soil columns and appeared in the first drainage water. The first field experiments were run south of Boise on the Sebree-Chilcott associated series. Radiosulfur was used in the form of dilute sulfuric acid soaked into absorbent cotton. Each wad was specifically placed in or adjacent to a slick spot. After several months, soil samples from these tagged slick spots indicated that some characteristic water movement had occurred. Improved techniques have been developed and the study will expand to include slick-spot soils in irrigated and dryland areas.

692. Kamaliddin, A. R., and Al-Ani, T. A. SOME SALINITY AND ELECTRICAL CONDUCTIVITY RELATIONSHIPS IN SALINE SOILS OF CENTRAL AND SOUTHERN IRAQ. Proc. Iraqi Sci. Soc. 4: 11-19. 1960-61. 475 P943

A report was given on the relationships of salinity and electrical conductivity in saline soils in Iraq.

693. Kamoshita, Y. ON THE CHEMICAL CONSTITUENTS OF PRINCIPAL SOIL TYPES IN JAPANESE PADDY FIELD AREA. Cong. Internatl. de la Sci. du Sol. Rap. 6(C, colloque du Riz): 499-502. 1956. 56.09 In8452

A report was given on some chemical analysis of principal soil types in paddy fields in Japan.

694. Kamoshita, Y., and Iwasa, Y. ON THE RUSTY MOTTLES IN PADDY FIELD SOILS. (Ja) J. Sci. Soil and Manure. 30(4): 185-188. 1959. 56.8 J27
English (Abs.)—Soil and Plant Food. 5(2): 97. Sept. 1959. 56.8 So38

Studies were reported on the chemical composition of rusty mottles in gray lowland and meadow soils in Japan.

695. Kanno, I., Honjo, Y., Arimura, S., and Tokudome S. GENESIS AND CHARACTERISTICS OF RICE SOILS DEVELOPED ON POLDER LANDS OF THE SHIROISHI AREA, KYUSHU. Soil Sci. and Plant Nutr. 10(1): 1-19. 1964. 56.8 So38

Morphological, mechanical, agrochemical, and mineralogical characteristics and pedogenesis of the four rice soils with different post-poldering ages in Japan were given.

696. Kanno, I., Tokudome, S., and Arimura, S. A PADDY SOIL DERIVED FROM WEATHERING PRODUCTS OF GRANITE, FUNAJIMA OF TEMANA, KUMAMOTO PREFECTURE. (Ja) Kyushu Agr. Res. 17: 117-118. May 1956. 107.6 K996

697. Kanno, I., Tokudome, S., Honjo, Y., and Arimura, S. PEDOLOGICAL STUDIES OF PADDY SOILS IN KYUSHU. II. Kyushu Agr. Expt. Sta. B. 4, (2): 275-287. Nov. 1956. 107.6 K996B

698. Kanwar, J. S., and Sehgal, J. L. CLASSIFICATION OF SALINE-SODIC AND NORMAL SOILS OF KARNAL DISTRICT. Indian Soc. Soil Sci. J. 10(1): 19-25. Ref. Mar. 1962. 56.9 In2

A report was given on the classification of some saline-sodic and normal soils in India. These soils do not need gypsum but their reclamation is possible when drainage is installed.

699. Kashayap, M. M., and Ghildyal, B. P. FABRICATION OF ELECTRICAL RESISTANCE GYPSUM BLOCKS FOR FIELD MOISTURE DETERMINATION. J. Indian Soc. Soil Sci. 12(3): 145-150. 1964.

A method for casting of electrical resistance gypsum blocks was described. Three types of molds and various consistencies of plaster of paris mix were tried. A mold with provision for keeping the electrodes in correct position prior to casting and a mix of ratio 2:1 by weight of plaster of paris to distilled water gave the best results.

700. Kataoka, J. EXPERIMENTAL RESEARCHES ON SUBSURFACE FLOW. II. A STUDY ABOUT THE RECESSION CONTENT AT THE BEGINNING STAGE. (Ja) Jap. Forestry Soc. J. 46(5): 163-165. May 1964. 99.8 N62
English summary.

A report was given on the coefficient of recession of subsurface flow at the beginning stage at different slopes and at different intensities of rainfall in fine sand, coarse sand, and gravel in Japan. The recession coefficient was in a linear relationship with the maximum discharge.

701. Kato, M., Shimazaki, F., and Ishisaki, T. STUDIES ON THE WATER-HOLDING-MECHANISM IN RICE FIELD SOIL. I. (Ja) Gigu U. Facul. Agr. Res. B. 1956(7): 153-157. Nov. 1956. 107.6 G364
English summary.

Bentonite applied to rice fields in Japan gave an increase in yield and helped retain the water on the land. The author doubted that the increased yield would pay for the bentonite used.

702. Kats, N. I. CONCERNING THE LIMITS OF PEAT SWAMPY SOILS, VEGETATION AREAS AND THEIR FORMATION IN CONNECTION WITH CLIMATIC CONDITIONS AND GEOLOGICAL HISTORY. (Rus) Pochvovedenie. 1957(5): 12-21. Ref. May 1957. 57.8 P34
English summary.

703. Kawaguchi, K., and Toratani, H. STUDY ON POSOSITY OF WATER-STABLE AGGREGATES IN PADDY AND UPLAND SOILS WITH REFERENCE TO AGGREGATE SIZE. (Ja) J. Sci. Soil and Manure. 30(8): 417-420. 1959. 56.8 J27
English abstract—Soil and Plant Food. 5(4): 196. Mar. 1960. 56.8 So38

Studies in Japan were reported on porosity of water stable aggregates in paddy and upland soils in Japan with reference to aggregate size. Because of the differences between the porosities of natural aggregates and those of puddled aggregate, it was indicated that the degree of development of soil structure was higher in upland than in paddy soils.

704. Kelmer, D., and Rosenberg, N. DETERMINING SOIL MOISTURE WITH ELECTRICAL INSTRUMENTS. (He) Hassadeh. 36: 1093-1096. Sept. 1956. 26 H27

705. Kemper, W. D. ESTIMATION OF OSMOTIC STRESS IN SOIL WATER FROM THE ELECTRICAL RESISTANCE OF FINELY POROUS CERAMIC UNITS. Soil SCi. 87(6): 345-349. 1959. 56.8 So3

A report was given on the use in the soil of finely porous ceramic resistance units to obtain an accurate estimate of the osmotic stress in the soil suction when the hydraulic stress is less than the pore-emptying stress of the cermatic used.

The use of this type of unit in conjunction with tensiometers, or the air permeability of ceramic cups, should make possible an accurate evaluation of both the osmotic and hydraulic components of moisture stress in saline soils.

706. Kemper, W. D. WATER AND ION MOVEMENT IN THIN FILMS AS INFLUENCED BY THE ELECTROSTATIC CHARGE AND DIFFUSE LAYER OF CATIONS ASSOCIATED WITH CLAY MINERAL SURFACES. Soil Sci. Soc. Amer. Proc. 24(1): 10-16. Ref. Jan./Feb. 1960. 56.9 So3

Theory was developed and the effects of the ions and the electrostatic charge associated with clay platelets on the movement of water and ions in thin films between particles or on particle surfaces were calculated for several systems.

707. Kemper, W. D., and Evans, N. A. MOVEMENT OF WATER AS EFFECTED BY FREE ENERGY AND PRESSURE GRADIENTS. III. RESTRICTION OF SOLUTES BY MEMBRANES. Soil Sci. Soc. Amer. Proc. 27: 485-490. 1963. 56.9 So3

The validity and method of using the self-diffusion coefficient of water to estimate movement in response to free energy gradients were outlined.

The dominant mechnaism of water transport through these membranes was viscous flow, even when osmotic pressure differences were causing the flow. Osmotic pressure and hydraulic pressure differences were equally effective in moving water through a membrane when the solutes were completely restricted by the membrane. When solutes were not completely restricted, osmotic pressure differences were less effective than hydraulic pressure differences in moving water through membranes. Equations including the sizes of the solute molecules and the pores were developed which predict the rate at which osmotic pressure differences move water through uncharged porous media.

708. Kemper, W. D., and Lutz, J. F. HYDRAULIC CONDUCTIVITY IN LARGE CHANNELS AS DETERMINED BY AN ELECTRIC ANALOG. Soil Sci. 81(4): 283-286. Apr. 1956. 56.8 So3

Data from the electric analog were used to develop an equation relating the number and length of highly conductive channels to their contribution to over-all hydraulic conductivity.

709. Kemper, W. D., Maasland, D. E. L., and Porter, L. K. MOBILITY OF WATER ADJACENT TO MINERAL SURFACES. Soil Sci. Soc. Amer. Proc. 28(2): 164-167. Mar./Apr. 1964. 56.9 So3

Mobility of water adjacent to Na- and Ca-saturated bentonite surfaces was estimated from diffusion rates of deuterium hydroxide in oriented clay pastes at several moisture contents. The first molecular layer of adsorbed water on Na- and Ca-clays had mobilities which were 30 and 5 percent, respectively, of the mobility of water molecules in bulk water. There was an indication of a slight reduction in mobility of water as far as 40Å. from the sodium-saturated clay. However, water more than three molecular layers from the solid surface had mobilities which were 60 percent of the mobility in bulk water. The mobility data indicated that water outside the first adsorbed molecular layer does not have viscosities more than 2.5 times the viscosity of bulk water.

710. Kennedy, R. A. THE RELATIONSHIP OF MAXIMUM PEAT DEPTH TO SOME ENVIRONMENTAL FACTORS IN BOGS AND SWAMPS IN MAINE. Maine Agr. Expt. Sta. B. 620, 57 pp. 1964. 100 M285

Radiocarbon dates of 12 peat samples taken from the bottom layers of peat in 12 Maine bogs in different areas of Maine provided geological information on the approximate rate and direction of ice frontal retreat by melting. The maximum range in the ages was only 1890 years which probably indicates fairly rapid deglaciation of central Maine.

Slope of the adjacent terrain, longitude, and altitude were significantly correlated with maximum peat depth in most of the regression equations.

Peat deposits in Maine were classified according to their drainage, altitude, configuaration, origin, and development. Field testing will be necessary to determine if this classification system is related to peat depth.

711. Kim, C. K. SOIL INVESTIGATION METHOD PRACTICED ON THE ZUIDERZEE PROJECT IN THE NETHERLANDS. (Ko) J. Agr. Engin. 6(1): 52-64. map. May 1964. 290.9 T12

712. Kincaid, D. R., Gardner, J. L., and Schreiber, H. A. SOIL AND VEGETATION PARAMETERS AFFECTING INFILTRATION UNDER SEMIARID CONDITIONS. Internatl. Assoc. Sci. Hydrol. 65: 440-453. 1963. 292.9 As7

On subwatersheds of the Walnut Gulch Experimental Watershed, measurements of precipitation and runoff showed extreme variation on the rainfall-runoff relation. This variation was attributed to irregularity of amount, intensity, and distribution of the precipitation and to unmeasured differences among the subwatersheds.

To ascertain effects of soil on infiltration, rain gages and Bouyoucos moisture blocks were installed on a 4.5-acre, grass-covered drainage area of igneous soil and on a 3.0-acre drainage area of calcareous soil supporting a shrub cover.

To determine the relation of infiltration to different factors in the soil-vegetation complex, infiltrometer tests were made with a Type-F infiltrometer on randomly selected 6 x 12-foot plots.

713. Kirkham, D. THEORY OF SEEPAGE INTO AN AUGER HOLE ABOVE AN IMPERMEABLE LAYER. Soil Sci. Soc. Amer. Proc. 22(3): 204-208. May/June 1958. 56.9 So3

The potential (hydraulic head) function, and from it flow rate was derived for ground water seeping into the sides and bottom of an auger hole extending a certain depth below the water table, but not penetrating to a horizontal impermeable layer. Using the formulas developed, two flow nets were computed, one for an empty auger hole and one for a half full one. A table of coefficients was given for computing quantities associated with the flow.

714. Kirkham, D., and Kunze, R. J. ISOTOPES METHODS AND USES IN SOIL PHYSICS RESEARCH. Advn. Agron. 14: 321-358. Ref. 1962. 30 Ad9

A review of the literature and a discussion were given on the use of isotope methods in soil physics research. The measurement of water, and soil density, were included.

715. Kita, D., and Kawaguchi, K. THE EFFECTS OF BOTH THE REDUCTION OF THE SOIL UNDER WATER-LOGGED CONDITION AND THE DEHYRATION OF THE REDUCED SOIL UPON THE SOIL STRUCTURE. I. ON THE STABILITY OF THE SOIL STRUCTURE. (Ja) J. Sci. Soil and Manure. 31(9): 375-418. 1960. 56.8 J27
English abstract—Soil and Plant Food. 6(4): 190-191. Mar. 1961. 56.8 So38

A report was given on the effect of waterlogging and drying on soil structure in some rice soils in Japan.

716. Kita, D., and Kawaguchi, K. THE EFFECTS OF BOTH THE REDUCTION OF THE SOIL UNDER WATER-LOGGED CONDITION AND THE DEHYDRATION OF THE REDUCED SOIL UPON THE SOIL STRUCTURE. II. ON THE SOIL POROSITY AND THE WATER-HOLDING CAPACITY OF SOIL. (Ja) J. Sci. Soil and Manure. 31(10): 495-498. 1960. 56.8 J27
English abstract—Soil Sci. and Plant Nutr. 7(1): 35. July 1961. 56.8 So38

Studies in Japan were reported on the effect of waterlogging and drying on rice soil on the soil on the soil porosity and waterholding capacities of the soil.

717. Klinge, A. F., and Davis, J. R. AUGER-HOLE AND PIEZOMETER METHODS IN INDIANA. Agr. Engin. 40(5): 272. May 1959. 58.8 Ag83

A report was given on the use and difficulty of use of the auger-hole and piezometer methods to measure hydraulic conductivity in the Clermont soil area in Indiana for the design of drainage systems.

718. Klute, A., Bruce, R. R., and Russel, M. B. THE APPLICATION OF THE DIFFUSITY CONCEPT TO SOIL MOISTURE MOVEMENT. Cong. Internatl. de la Sci. du Sol. Rap. 6(B, comn. I.): 345-354. 1956. 56.09 In8452

A discussion was given on a flow equation for water in a porous medium in which a diffusity function is introduced.

719. Klute, A., and Gardner, W. R. TENSIOMETER RESPONSE TIME. Soil Sci. 93(3): 204-207. Mar. 1962. 56.8 So3

The differential equation of flow of water across a tensiometer cup was used to show how corrections for a non-zero response time of a tensiometer could be made if the instrument characteristics are limiting. The case in which the soil water transmission properties were limiting was briefly discussed.

720. Klute, A., and Peters, D. B. A RECORDING TENSIOMETER WITH A SHORT RESPONSE TIME. Soil Sci. Soc. Amer. Proc. 26(1): 87-88. Jan./Feb. 1962. 56.9 So3

An application of a strain gauge diaphragm-type pressure transducer to measure the water pressure inside a tensiometer cup was described. The tensiometer system has the following important advantages: (1) A response time of 1 second or less; (2) a high gauge sensitivity, at least 3 x 10 millibars per cc.; and (3) the convenience of recording. Measuring can be made in flow systems with rapidly varying tension and a minimum of disturbance of the system.

721. Kobayashi, H. ON ELECTRICAL SOIL MOISTURE METER INSTRUMENT IN FARMS. III. ON SELF-RECORDING SOIL MOISTURE METER OF SIX ELEMENTS. (Ja) Gifu U. Facul. Agr. Res. B. 8, pp. 158-165. Nov. 1957. 107.6 G364
English summary.

A self-recording soil moisture meter used in Japan was described.

722. Kobayashi, H., and Onogi, M. ON ELECTRICAL SOIL MOISTURE METER INSTRUMENT IN FARMS. IV. (Ja) Gifu U. Facul. Agr. Res. B. 11, pp. 196-201. Dec. 1959. 107.6 G364
English summary.

A report was given on the use of the electrical resistance unit to measure soil moisture in Japan.

723. Kodani, Y., and Kimura, H. ON THE ELECTRICAL METHOD FOR MEASURING SOIL MOISTURE. (Ja) Soc. Agr. Met. Japan. J. Agr. Met. 15(4): 147-150. Mar. 1960. 340.9 So1
English summary.

A report was given on the use of the Bouyoucos plaster of paris block and nylon units for soil moisture measurement in Japan.

724. Kolyasev, F. E. MOVEMENT OF SOIL WATER AND SOME MEANS OF CONTROLLING IT. 24 pp. Ref. (OTS60-51002) Transl. 12591
Translation from Vopr. Agron. Fiz. pp. 11-29. 1957.

A discussion was given of the movement of soil water and some means of controlling it.

725. Koning, J. C. De, and Wiggers, A. J. SOIL CONDITIONS IN EASTERN FLEVOLAND. (Du) Van Zee tot Land 15, 52 pp. Ref. 1955. 54.8 V26
English summary.

Soil conditions were given for Eastern Flevoland in the Netherlands which is the third polder to be reclaimed in the former Zuiderzee area. When dry the level of the land will be between 0.5 m.-4.5 m. below sea level. Shrinking of the land expected for a period of 80-100 years was reported on the soil maps.

The soil maps show what drainage system of open drains will be needed before the final closed drains can be installed for complete drainage. The drought-susceptible soils will be provided with a system of subterraneous irrigation. The soil maps also show the areas needing deep plowing.

726. Koo, R. C. J. THE DISTRIBUTION AND UPTAKE OF SOIL MOISTURE IN CITRUS GROVES. Fla. State Hort. Soc. 1961 Proc. 74: 86-90. 1962. 81 F66

Soil moisture distribution in orange and grapefruit groves on Lakeland fine sand was studied with the Nuclear-Chicago d/M gauge. On a typical Lakeland soil with clay at 8 feet, 90 percent of the soil moisture removed came from the surface 4 to 5 feet. On a deep sand, the same percent of soil moisture loss was distributed in the surface 8 to 9 feet with two-thirds of it in the 3 to 8 foot zone. Grapefruit trees showed a higher rate of evapotranspiration than oranges of the same age. Soil moisture content beneath grapefruit trees was consistently lower than at the drip. The difference became more pronounced in periods of light rainfall. Similar but much smaller differences were found for orange trees.

727. Kortum, F. ON THE WATER SUPPLY IN WEIGHING LYSIMETERS IN COMPARISON WITH DISTANT GROUND WATER IN SAVELY LOCATIONS OF THE NORTH GERMAN GLACIAL DRIFT. (Ge) International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 38-42. 1959. 292.9 As7C

728. Kovda, V. A., Egorov, V. V., Muratova, V. S., and Strogonov, B. P. CLASSIFICATION OF SOILS WITH RESPECT TO THE DEGREE OF SALINITY AND TO THE TYPE OF SALT-CONTENT COMPOSITION. (Rus) Bot. Zhur. [Moskva] 45(8): 1123-1131. Ref. Aug. 1960. 451 R923
English summary.

The existing classification of soils according to salinity were reviewed and a new classification was proposed for U.S.S.R. based on the degree of salinity and the type of salt content composition.

729. Kozachyn, J., and McHenry, J. R. A METHOD FOR INSTALLATION OF ACCESS TUBES AND THE DEVELOPMENT OF FIELD EQUIPMENT FOR MEASURING SOIL MOISTURE BY NEUTRON SCATTER. Agron. J. 56(4): 443-444. July/Aug. 1964. 4 Am34P

The equipment and method used to install access tubes for measuring soil moisture by the neutron scatter method in Mississippi were described and illustrated along with a lightweight 2-wheeled cart used for carrying the neutron probe.

730. Krantz, B. A. SOIL SURVEY INTERPRETATION—INTERPRETATION OF SOIL CHARACTERISTICS IMPORTANT IN SOIL MANAGEMENT. Soil Sci. Soc. Amer. Proc. 22(2): 155-156. 1958. 56.9 So3

A discussion was given of the basic information needed to predict how a soil will react or respond to the application of alternative soil and water management practices. The basic soils information which the soil survey provides must be properly interpreted by the farm planner or advisor if he is to develop a soil and water management system suited to any given farm.

The use of soil survey interpretation for the use in surface and subsurface drainage were included.

731. Kroth, E. M., and Jamison, V. C. AVAILABLE WATER STORAGE CAPACITY ESTIMATES OF A TERRACED CLAYPAN SOIL. Soil Sci. Soc. Amer. Proc. 24(2): 146-147. Mar./Apr. 56.9 So3

A study of the type of sample to use in estimating the available water storage capacity of a soil was set up in April, 1958, on a terraced Mexico silt loam where fall and runoff records were obtained. Mexico silt loam is a claypan soil, the pan (55 to 60 percent clay) comprising about the 15- to 23-inch layer.

732. Kroth, E. M., Jamison, V. C., and Grogger, H. E. SOIL MOISTURE SURVEY OF SOME REPRESENTATIVE MISSOURI SOIL TYPES. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-34, 57 pp. 1960. A56.9 R31

Knowledge of the amount of water retained by a soil that is usable for growing plants is of value to farmers, designers of irrigation systems, and a wide range of researchers interested in plant-soil relationships.

An available water-holding capacity survey was begun in 1955 for the major soil types of Missouri. A technical soil description of each soil type was given along with the chemical analysis, mechanical analysis, and the available water per inch for each horizon of each soil type.

733. Krumin'sh, K. A. ANALYSIS AND CLASSIFICATION OF THE RECLAIMED SOILS OF LATVIAN SSR. (Rus) Latv. PSR Zipatnu Akad. Augsnes Zinibu un Zemkopibas Inst. Augsne un Raza. 5: 3-12. 1956. 56.9 R44

734. Krylov, M. M. STUDIES OF GROUND-WATER BALANCE IN IRRIGATED REGIONS OF CENTRAL ASIA. In INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY. SYMPOSIUM OF HANNOVERSCH-MUNDEN. GENTBRUGGE. 2: 43. 1959. 292.9 As7C

A report was given on the use of lysimeter to study ground water balance in irrigated areas of Central Asia.

735. Kucheryava, L. F. KINDS OF PEAT, STRATIGRAPHY, AND HISTORY OF DEVELOPMENT OF THE MESOTROPHIC BOGS OF THE SNOV RIVER VALLEY. (Uk) Ukrayin. Bot. Zhur. 19(1): 100-106. 1962. 450 J8212J
English summary.

A report was given on the kinds of peat, the stratigraphy, and history of development of three mesotropic bogs in Ukrania.

736. Kuczarow, W. CONTRIBUTION TO THE PEDOLOGICAL STUDY OF SWAMPY BOTTOMS AT HIGH ELEVATIONS IN URUNDI REGION OF KISOZI. (Fr) Inter-African Soils Conf. Proc. 2: 1415-1424. 1954. 56.09 In846

A report was given on the soils in Kisozi area in Africa and their drainage problems. The soils had a moisture content of up to 90 percent, the mineral content was variable; and the pH varied from 3.8 to 5.1.

737. Kunze, R. J., and Kirkham, D. CAPILLARY DIFFUSION AND SELF-DIFFUSION OF SOIL WATER. Soil Sci. 97(3): 145-151. Mar. 1964. 56.8 So3

The capillary diffusion coefficient (D_c) and molecular self-diffusion coefficient (D_s) for the liquid phase of soil water were determined for three moist soils (silt loam, silty clay loam, and clay) over a wide range of their moisture contents. A curve fitting the data points of D_c versus D_s was found to be, within experimental error, the same curve, for the three soils. The curve was expressed in the form of a theoretical relationship.

738. Kunze, R. J., and Peters, D. B. A RECORDING BALANCE FOR MEASURING UNSATURATED MOISTURE FLOW IN SOIL. Soil Sci. Soc. Amer. Proc. 28(1): 130-131. Jan./Feb. 1964. 56.9 So3

A recording balance was described and illustrated for measuring unsaturated moisture flow in soils.

739. Kurm, H. THE MARSHES OF THE ISLAND HIIUMAA. (Es) Eesti Geog. Seltsi Aastar. 1962: 174-195. map. 331.9 Ee7
German summary.

740. Kutilek, M. FIELD DETERMINATION OF HYDRAULIC CONDUCTIVITY OF SOIL BELOW THE WATER TABLE. (Cz) Czech. Min. Zemedel. Les. Vodn. Hospodar. Ustav. Vedeckotech. Inform. Rostlinna Vyroba. 36(12): 1283-1288. Ref. Dec. 1963. 64.9 C33
English summary.

A report was given on methods of field determination of hydraulic conductivity of soils. A new method was proposed for the determination of K from the rate of rise of water in a dug pit.

741. Kuzmak, J. M., and Sereda, P. J. THE MECHANISM BY WHICH WATER MOVES THROUGH A POROUS MATERIAL SUBJECTED TO A TEMPERATURE GRADIENT. I. INTRODUCTION OF A VAPOR GAP INTO A SATURATED SYSTEM. Soil Sci. 84(4): 291-299. Ref. Oct. 1957. 56.8 So3

Research was reported on the influence of a gap (of vapor) on the rate of movement in an otherwise saturated system in a study of the mechanism by which water moves through a porous material subjected to a temperature gradient.

742. Lagunova, E. P. ROLE OF VEGETATION IN CHANGING THE [FORMATION] SOLONETZ SOILS OF SOUTH-EASTERN SHIRVAN [AZERBAIDZHAN SSR]. (Rus) Poch. Inst. im. V. V. Dokuchaeva. Trudy. 47: 5-78. Ref. 1955. 56.9 P44

743. Lawless, G. P., MacGillivray, N. A., and Nixon, P. R. SOIL MOISTURE INTERFACE EFFECTS UPON READINGS OF NEUTRON MOISTURE PROBES. Soil Sci. Soc. Amer. Proc. 27(5): 502-507. Sept./Oct. 1963. 56.9 So3

The effects of air-soil interfaces and of wet-dry soil interfaces were reported for neutron probes of four different designs.

744. Leamy, M. L., and Blackmore, L. C. › THE PEAT SOILS OF THE AUCKLAND ISLANDS. New Zeal. J. Agr. Res. 3(3): 526-546. map. Ref. June 1960. 23 N4892

A discussion was given of some peat soils found on the Auckland Islands in New Zealand.

745. Lemon, E. R. SOIL AERATION AND PLANT ROOT RELATIONS. I. THEORY. Agron. J. 54: 167-170. 1962. 4 Am34P

In order to make a rational approach to the physics of gas exchange between plant roots and the soil environment, a simple model was proposed.

The solution of the diffusion equation for the two cases pinpoints the need to consider the problem of soil aeration as a unified soil-plant problem. One needs to know the oxygen demand characteristics of the plant root as well as the oxygen supplying power of the soil. The root and soil parameters needed in the solution of the total problem were given.

746. Lemon, E. R., and Wiegand, C. L. SOIL AERATION AND PLANT ROOT RELATIONS. II. ROOT RESPIRATION. Agron. J. 54: 171-175. 1962. 4 Am34P

To adequately characterize the oxygen "supplying power" of the environment around a root growing in the soil, it was necessary to know the critical "demand" characteristics of the root. As a natural sequel to the theoretical development of the problem, a brief review of the factors determining these "demand" characteristics were given. The evidence indicates that: (1) The rate of metabolic oxygen uptake by root tissues varied with the genetic background and the physiological age of the tissue. (2) When oxygen was plentiful, the "substate" supply (or other necessary compounds) at the reaction loci determined the reaction rate. (3) When the oxygen concentration at the root surface was below the critical level, diffusion controlled the rate of oxygen uptake. This physical process was relatively insensitive to temperature. And (4) the critical oxygen concentration at the root surface was strongly dependent upon the radius of the root and the diffusion coefficient of oxygen within the root.

747. Levee, W. M., Khan, S. H., and Qasem, A. SOIL, AGRICULTURE AND ECONOMICS OF SOUTHERN RAJSHAHI. Pakistan J. Biol. and Agr. Sci. 5(1): 18-29. map. 1962. 22 P173

Soils and agricultural surveys in Pakistan were made to collect information and data necessary to determine the irrigation, drainage, and flood control data needed for the area.

748. Leverington, K. C. SOIL SALINITY IN SOME QUEENSLAND SOILS. Queensland Soc. Sugar Cane Technol. Proc. 28: 173-177. 1961. 65.9 Q332

A report was given on soil salinity on some soils in Queensland in Australia and their methods of improvement.

749. Lewis, G. C., Jordan, J. V., and Fosberg, M. A. TRACING MOISTURE MOVEMENT IN SLICK SPOT SOILS WITH RADIOSULFUR. II. Soil Sci. Soc. Amer. Proc. 23(3): 206-210. Ref. May/June 1959. 56.9 So3

A report was given of a study with radiosulfur of the pattern of moisture movement in slick spots and associated soils. After several months, soil and plant samples from the areas indicated that characteristic patterns of moisture movement had occurred.

750. Lightfoot, L. C., Smith, S. T., and Malcolm, C. V. REPORT OF A SURVEY OF SOIL SALINITY IN THE AGRICULTURAL AREAS OF WESTERN AUSTRALIA. West. Austral. Dept. Agr. J. (ser. 4)5(7): 396-398, 401-402, 405-406, 409-410. map. July 1964. 23 W52J

A report was given of a survey made of soil salinity areas in western Australia and their improvement and management by fencing, cultivation, and seeding of salt tolerant perennial plants.

751. Lindner, H. AN APPARATUS FOR MEASUREMENT OF MOISTURE CONTENT AND TEMPERATURE OF SOIL WITH THE HELP OF THERMISTORS. (Ge) Albrecht-Thaer-Arch. 8(1/3): 79-87. Ref. 1964. 18 AL1. English summary.

An apparatus was described that is used in Germany to measure moisture content and temperature of the soil with the help of thermistors.

752. Liu, T. T., and Hsi, C. L. STUDIES ON THE SALT ACCUMULATION LAW OF THE SALINE SOILS OF HUNAN PROVINCE. (Ch) Zhongguo Nongye Kexue. 12: 30-35. Dec. 1963. 22.5 N928

753. Lo, A. H. METHODS FOR MEASURING PERCOLATION WATER IN PADDY FIELD. (Ch) Taiwan Water Conserv. (ser. 11)3(43): 45-50. Sept. 1963. 292.8 T13
English summary.

Three methods were given of determining water percolation in paddy fields in China.

754. Loddesol, A. MARSH AND PEAT RESOURCES IN NORWAY; PRESENT AND FUTURE USE. (No) Norske Myrselsk. Meddel. 61(5): 101-114. Ref. Oct. 1963. 11 N813

755. Long, F. L., Daniels, J. M., Ritchie, R. T., and Ellerbe, C. M. SOIL MOISTURE CHARACTERISTICS OF SOME LOWER COASTAL PLAIN SOILS. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-82, 22 pp. map. Sept. 1963. A56.9 R31

Soil moisture characteristics of some lower Coastal Plains soils of Georgia and South Carolina were given for the design of drainage and irrigation systems.

756. Long, F. L., and Morris, H. D. ANALYSIS OF CHEMICAL PROPERTIES SHOWS PRODUCTION POTENTIAL OF BRACKISH MARSH SOILS OF GEORGIA. Ga. Agr. Res. 5(1): 4-6. 1963. 100 G295

Laboratory and greenhouse investigations were reported that determined the chemical properties and fertilizer requirements of three brackish marsh soils of Georgia.

757. Longenecker, D. E., and Lyerly, P. J. MAKING SOIL PASTES FOR SALINITY ANALYSIS: A REPRODUCIBLE CAPILLARY PROCEDURE. Soil Sci. 97(4): 268-275. 1964. 56.8 So3

A new procedure for making soil pastes for salinity analysis by capillary absorption of moisture was proposed. The method promises several advantages over the current procedure of hand-mixing. These are: (1) Better reproducibility of moisture content of the pastes by elimination of the variability occasioned by hand-mixing; (2) possibly better correlation between saturation extract values and soil cation-exchange equilibria due to a standardized wetting technique; (3) elimination of some of the difficulties inherent in making pastes with fine-textured and/or high-sodium soils; (4) introduction of a wetting procedure based on the natural moisture-adsorptive forces of the soil; and (5) probability that the proposed method may be more adaptable to large-volume service laboratory procedures.

758. Longwell, T. J., Parks, W. L., and Springer, M. E. MOISTURE CHARACTERISTICS OF REPRESENTATIVE TENNESSEE SOILS. Tenn. Agr. Expt. Sta. B. 367, 46 pp. map. Ref. Sept. 1963. 100 T25S

A report was given on the moisture characteristics of representative Tennessee soils as an aid in planning effective soil water management.

759. Loughry, F. G. QUANTITATIVE RELATIONSHIP OF SOIL MOTTLING TO NATURAL SOIL DRAINAGE PROFILES (AERATION STATUS). Diss. Abs. 21(9): 2429. Mar. 1961. 241.8 M58

An abstract was given of an experiment in Pennsylvania to provide more quantitative measures of soil mottling to improve its use as an indicator of natural soil drainage.

760. Low, P. F. EFFECT OF OSMOTIC PRESSURE ON DIFFUSION RATE OF WATER. Soil Sci. 80: 95-100. 1955. 56.8 So3

An equation was developed relating the hydraulic and osmotic pressure gradients to the rate of diffusion of water. It shows that the osmotic pressure acts as a negative hydraulic pressure in its influence on water diffusion. The equation was tested for clay suspensions and shown to be valid.

761. Lowry, G. L., and Finney, J. H. A LYSIMETER FOR STUDYING THE PHYSICAL AND CHEMICAL CHANGES IN WEATHERING COAL SPOIL. Ohio Agr. Expt. Sta. Res. C. 113, 17 pp. map. Ref. Aug. 1962. 100 Oh3R

A report was given on a lysimeter for studying the physical and chemical changes in weathering coal spoil in Ohio.

762. Luken, H. SALINE SOILS UNDER DRYLAND AGRICULTURE IN SOUTHEASTERN SASKATCHEWAN (CANADA) AND POSSIBILITIES FOR THEIR IMPROVEMENT. I. DISTRIBUTION AND COMPOSITION OF WATER-SOLUBLE SALTS IN SOILS IN RELATION TO PHYSIOGRAPHICAL FEATURES AND PLANT GROWTH. Plant and Soil. (1): 1-25. Ref. Aug. 1962. 450 P696

Soil salinization in some areas of southeastern Saskatchewan in Canada was discussed from the standpoint of its occurrence in relation to climatic conditions, soil type, topography, and land use.

763. Lund, Z. F. AVAILABLE WATER-HOLDING CAPACITY OF ALLUVIAL SOILS IN LOUISIANA. Soil Sci. Soc. Amer. Proc. 23(1): 1-3. 1959. 56.9 So3

A water-holding capacity survey of 22 profiles in Louisiana gave a positive correlation of 0.626 for silt and range of available moisture. Data indicated clay held moisture at suction values too high for plant availability. A negative relationship existed between sand and range of available water. Permeability was positively correlated with percent large pores.

Many of the soils of Louisiana ranged from medium to fine texture and had large amounts of water available to plants. Permeability was a problem due to the low percent large pores.

764. Lund, Z. F., and Loftin, L. L. PHYSICAL CHARACTERISTICS OF SOME REPRESENTATIVE LOUISIANA SOILS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-33, 83 pp. 1960. A56.9 R31

A report was given of physical characteristic of some representative soils in Louisiana.

765. Lund, Z. F., Loftin, L. L., and Earle, S. L. SUPPLEMENT TO PHYSICAL CHARACTERISTICS OF SOME REPRESENTATIVE LOUISIANA SOILS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-33-1: 43 pp. 1961. A56.9 R31

In recent years, increased attention has been focused on soil moisture control to improve farm efficiency. In Louisiana, this may involve water removal by drainage, irrigation, or a combination of drainage and irrigation. Rainfall, particularly since 1950, has been such that periods of inadequate, or quite excessive, rainfall have occurred almost every year during the growing season. Irrigation and drainage, sometimes both in the same year, have been profitable in alleviating extremes in moisture caused by poor rainfall distribution. Physical characteristics were given for ten soil profiles.

766. Lupinovich, I. S., and Afanas'ev, N. I. DETERMINATION OF WATER "CONSTANTS" OF PEAT-BOGGY SOILS. (Rus) Akad. Nauk Belorusskoi SSR. Dok. 6(11): 729-731. Nov. 1962. 511 M663D

767. Lupinowitsch, I. S. MOOR SOIL RECLAMATION IN U.S.S.R. (Ge) Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comm. VI): 661-668. 56.09 In8452
English summary.

A report was given on bog soils in the U.S.S.R. and their reclamation and use.

768. Luthin, J. N. METHOD OF MEASURING SOIL HYDRAULIC CONDUCTIVITY IN SITU. Nature [London] 192(4800): 383-384. Oct. 28, 1961. 472 N21

A field method was proposed for measuring the soil hydraulic conductivity by measuring the rate of flow of water out of a cavity beneath a pipe.

769. Maasland, M., and Haskew, H. C. THE AUGER HOLE METHOD OF MEASURING THE HYDRAULIC CONDUCTIVITY OF SOIL AND ITS APPLICATION TO TILE DRAINAGE PROBLEMS. Cong. Irrig. and Drainage Trans. 3(3): 8.69-8.114. Ref. 1957. 55.9 C7652

A report was given on the use of the auger hole method to measure the hydraulic conductivity of soil and its application to tile drainage problems in New South Wales, Australia.

770. MacFarlane, I. C. A REVIEW OF THE ENGINEERING CHARACTERISTICS OF PEAT. J. Soil Mech. and Found. Div., ASCE 85(SM1): 21-35. Feb. 1950. 290.9 Am3Ps

A resume of information contained in a number of references concerned in some way with physical and mechanical properties of peat was given. Information was presented under the headings: (1) Classification; (2) percent ash; (3) acidity reaction; (4) density and specific gravity; (5) water holding capacity; (6) void ratio and shrinkage on drying; (7) permeability; (8) shear strength; (9) bearing capacity; and (10) consolidation characteristics and settlement.

A list of 25 references was included.

771. McGuinness, J. L., Dreibelbis, F. R., and Harrold, L. L. SOIL MOISTURE MEASUREMENTS WITH THE NEUTRON METHOD SUPPLEMENT WEIGHING LYSIMETERS. Soil Sci. Soc. Amer. Proc. 25(5): 339-342. Sept./Oct. 1961. 56.9 So3

Evaluation of soil moisture changes with the neutron method agreed closely with that obtained with weighing lysimeters.

772. McGuinness, J. L., and Urban, J. B. SOIL MOISTURE SAMPLING PLAN FOR WATERSHEDS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-87, 12 pp. Feb. 1964. A56.9 R31

The general concepts of sampling theory as they apply to soil moisture measurements in hydrology were given. Frequent random selection of sampling sites in a watershed is usually not practical. As a rule, the procedure is to choose fixed sites, install instruments, and read them periodically. Furthermore, soil moisture evaluations need to be related to soil profile characteristics. In fact, the hydrologist must know the surface and subsurface characteristics of the watershed and have a clear idea of the objectives of the soil moisture program before the statistical layout can be planned.

The purpose for which the sampling is made will influence the intensity of sampling.

A guide for designing a soil moisture sampling plan for any specific watershed area, based on an example from the Coshocton Station, was described.

773. McHenry, J. R. DETERMINATION OF DENSITIES OF RESERVOIR SEDIMENTS IN SITU WITH A GAMMA PROBE. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-53, 10 pp. Apr. 1962. A56.9 R31

The attenuation of gamma emissions on passing through matter was adapted for determining the densities, in situ, of reservoir sediments. The equipment was described, as well as the procedures for the necessary calibration of the detector instrument. The attenuation of gamma rays was found to be a linear (log) function of the density of the sediment. Excellent precision was obtained with the equipment described.

774. McHenry, J. R. DETERMINATION OF SEDIMENT DENSITY BY GAMMA ATTENUATION. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-61, 16 pp. Oct. 1962. A56.9 R31

The measurement of density as a function of the attenuation of a radioactive emission was evaluated as a means of determining sediment density and concentration in silt boxes, laboratory flumes, and flowing streams. The transmission method shows considerable promise on the basis of laboratory investigations. Plans for field installations were discussed.

775. McHenry, J. R. THEORY AND APPLICATION OF NEUTRON SCATTERING IN THE MEASUREMENT OF SOIL MOISTURE. Soil Sci. 95(5): 294-307. Ref. May 1963. 56.8 So3

A discussion was given on the theory and application of the neutron scattering for measuring soil moisture. Difference in response of a Nuclear-Chicago P-19 and a Troxler Model 102 neutron probe were presented.

776. McIlroy, I. C. A LYSIMETER INSTALLATION AT ASPENDALE. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 11: 45-47. 1958. 278.9 Un3

A report was given on the installation of lysimeters at Aspendale, Australia for soil moisture measurement.

777. Makkink, G. F. LYSIMETERS IN THE NETHERLANDS. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 5-12. Ref. 1959. 292.9 As7C

A survey was given on the existing lysimeter sets in the Netherlands. Their aims, construction, vegetation, instrument arrangements and research possibilities were discussed. A bibliography on Dutch lysimeter research was included.

778. Makkink, G. F. LIMITATIONS AND PERSPECTIVES OF LYSIMETER RESEARCH. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 13-25. 1959. 292.9 As7C

A discussion was given on the use and limitation of lysimeter research.

779. Makowski, J. CONTINUOUS MEASUREMENT OF THE LEVEL OF RUNNING WATER BY GAMMA RAYS. In translated reprint from: "HYDROTECHNICAL ARCHIVES AND THE HYDROTECHNICAL PAPERS". J. Polish Acad. Sci. Hydrotechnic Structure Inst. Gdansk. OTS 60-21566. pp. 4-9. 1963. 290 W262.

A report was given on the continuous measurement of the running water level by gamma radiation in Poland.

780. Maksimow, A., Okruszko, H., and Liwski, S. PEAT LANDS OF BIEBRZA. (Pol) Rocz. Nauk Roln. Ser. A, Roslinna. 71:351-405. 1955. 20.5 R59
English summary.

A report on the formation of the peat lands occurring in Biebrza was given to determine their economic utilization. Most of the land was composed of sedge and reed peat. It was recommended that grass and trees be grown on most of the area. Part of the area has a sufficiently decomposed layer of peat that it could be utilized for fuel to a depth of 0.5 to 0.7 meters and then for agricultural purposes.

781. Marais, P. G., and Smit, W. B. D. V. EFFECT OF BULK DENSITY OF SOILS ON THE CALIBRATION CURVE OF THE NEUTRON MOISTURE METER. So. African J. Agr. Sci. 3(3): 475-477. Sept. 1960. 24 Su3

A note was given on research in South Africa on the effect of bulk density of soils on the calibration curve of the neutron moisture meter.

782. Maran, B. CONTRIBUTION TO THE STUDY OF RENDZINA SOILS OF THE PODEBRADY MARSHES. (Cz) Ceskoslov. Akad. Zemedel. Ved. Sborn. Rostlinna Vyroba. 7(8): 1063-1082. Ref. Aug. 1961. 64.9 C33
German summary.

783. Maran, B., and Lhota, O. IMPORTANCE OF TESTING PERMEABILITY OF PEAT FOR CULTIVATION AND RECLAMATION OF PEAT-BOGS. (Cz) Ceskoslov. Akad. Zemedel. Ved. Sborn. Lesn. 31(12): 1037-1052. Ref. Dec. 1958. 99.9 C334
English summary.

Experiments were reported that were conducted at the Peat Station at Borkovice, southern Bohemia to study the permeability of peat and its physical properties in arable and sub-arable layers, up to a depth of 60 cm. From these results, recommendations were given for the cultivation, drainage, and reclamation of peat bogs.

784. Marias, P. G., and Smit, W. B. D. V. NEUTRON MOISTURE METER-CIRCUIT DIAGRAM AND OPERATION. So. African J. Agr. Sci. 3(1): 115-130. Ref. Mar. 1960. 24 Su3

The circuit diagram was given of a neutron moisture meter whose main components are a probe unit and a dekatron scaler. The operation was reported for its use in the field and laboratory in South Africa.

785. Marsh, A. W. TENSIOMETERS: KEY TO INCREASED PROFITS. West. Grower and Shipper. 32(2): 15-17, 34. Feb. 1961. 280.38 W52

A report was given on the use of tensiometers to measure soil moisture for vegetable crops.

786. Marshall, T. J. RELATIONS BETWEEN WATER AND SOIL. Commonwealth Bur. Soils. Tech. Commun. 50, 91 pp. Ref. 1959. 56.9 Im72

A technical discussion was given on the relations between water and soil. One chapter was devoted to the various methods of soil moisture measurement in situ.

787. Marston, R. B. CHARACTERISTICS OF A COMMERCIALLY-AVAILABLE, SURFACE-MOISTURE NUCLEAR PROBE. Internatl. Assoc. Sci. Hydrol. B. 9(2): 80-89. Ref. June 1964. 292.9 As7

A report was given on the use and calibration of a commercially available nuclear probe.

788. Martin, C. K. SOIL MANAGEMENT STUDIES OF THE CLAYPAN SOILS OF SOUTHERN ILLINOIS WITH EMPHASIS ON DRAINAGE AND AERATION. Diss. Abs. 22(4): 960. Oct. 1961. 241.8 M58

A report was given on soil management studies and drainage to improve drainage and aeration on claypan soils of southern Illinois. Drainage wells were found to be very effective for improving these soils.

789. Mathieu, A. L., and Toogood, J. A. A SELF-RECORDING SOIL PENETROMETER. Canad. J. Soil Sci. 38(2): 100-102. Aug. 1958. 56.8 C162

A new model was described of a recording pentrometer used in Canada to measure soil compaction and consistency.

790. Matiunin, N. F. EFFECTIVENESS OF VARIOUS METHODS OF DETERMINING SOIL MOISTURE IN THE ESTABLISHMENT OF WATERING PERIODS FOR COTTON. (Rus) Khlopkovodstvo. 1960(4): 24-27. Apr. 1960. 72.8 K522

791. Matsuo, H., and Soto, Y. STUDIES ON WATER PERMEABILITY OF PADDY SOILS. I. SAMPLING AND MEASURING METHODS FOR PERMEABILITY OF PADDY SOILS. (Ja) Kyushu Agr. Expt. Sta. B. 5(4): 259-267. Ref. Nov. 1959. 107.6 K996B

Methods were discussed of sampling and measuring the permeability of paddy soils in Japan.

792. Matsuo, H., and Soto, Y. STUDIES OF WATER PERMEABILITIES OF PADDY SOILS. II. INVESTIGATIONS OF PERMEABILITIES OF FIELD SOILS. (Ja) Kyushu Agr. Expt. Sta. B. 5(4): 269-276. Ref. Nov. 1959. 107.6 K996B
English summary.

A report was given on some investigations in Japan on the permeability of paddy soils in the field.

793. Matsuo, H., and Soto, Y. ON SOME PHYSICAL PROPERTIES OF PADDY SOIL DURING THE TERM OF RICE CULTIVATION. (Ja) J. Sci. Soil and Manure. 31(7): 295-299. 1961. 56.8 J27
English abstract—Soil and Plant Food. 6(4): 186-187. Mar. 1961. 56.8 So38

Records were given on some physical properties of paddy soil during one term of rice growing in Japan.

794. Matsuzaka, Y., Yamada, Y., Iwasa, Y., and Nagatsuka, S. ON THE CLASSIFICATION OF PADDY FIELDS BASED ON SOIL SERIES—A CASE IN FUJI CITY IN SHIZUOKA PREFECTURE. (Ja) J. Sci. Soil and Manure. 34(7): 259-264. 1963. 56.8 J27
English abstract—Soil Science and Plant Nutrition. 10(1): 43. Jan. 1964. 56.8 So38

Studies in Japan were reported on the classification of paddy fields based on soil series.

795. Mazurak, A. P., Cosper, H. R., and Rhoades, H. F. RATE OF WATER ENTRY INTO AN IRRIGATED CHESTNUT SOIL AS AFFECTED BY 39 YEARS OF CROPPING AND MANURIAL PRACTICES. Agron. J. 47: 490-493. 1955. 4 Am34P

A constant rate of water entry into Tripp soil was usually obtained after 2 hours of irrigation. The intake of water was influenced by applying the results from manure and cropping history during 39 years. Maximum rates of water entry after 2 hours of irrigation were obtained in the continuous alfalfa plots; the rates were 30.6 and 37.0 cm. per hour for the nonmanured and manured treatments, respectively. A minimum rate, 0.5 cm. per hour, of water entry into soil after 2 hours of irrigation was obtained for continuous corn. Where manure was applied annually since 1942 to the continuous corn plot, the rate of water entry was 6.8 cm. per hour.

796. Meek, B. D., MacKenzie, A. J., and Stockinger, K. R. EVALUATION OF A RADIOACTIVE TRACER METHOD FOR MEASURING WATER INTAKE OF SOILS. Soil Sci. Soc. Amer. Proc. 28(2): 153-155. Mar./Apr. 1964. 56.9 So3

A tracer method was evaluated for measuring water intake by application of radioactive gold to the irrigation water.

797. Meer, K. Van Der. SOIL SURVEY PROBLEMS CONCERNING IRRIGATION AND IRRIGATED AGRICULTURE. United Nations Conf. Appl. Sci. and Technol. Benefit Less Developed Areas. [Working Papers, Agr.] 2(86): 1-3. Sept. 27, 1962. (E/CONF. 39/C/86) 281.9 Un392

A report was given on the value of soil surveys in the Netherlands to decide what drainage, if any, is needed for the production of irrigated crops.

798. Meijers, P. G. SOILS AND LAND USE IN THE NETHERLANDS. Adv. Agron. 11: 333-368. Ref. 1959. 30 Ad9

A review of the literature and a discussion were given on the various types of soils in the Netherlands and their land use.

799. Meriaux, S., and Gilly, G. PEDOLOGICAL AND AGRONOMICAL CONSIDERATION OF THE SAONE VALLEY. (Fr) France Inst. de la Rech. Agron. Ann. Ser. A., Ann. Agron. 9(5): 593-636. Ref. Sept./Oct. 1958. 14 F8499
English summary.

A discussion of the soils in the Saone Valley in France was given along with the problems connected with irrigation and drainage. It was recommended that the area be reestablished to grassland.

800. Merriam, R. A. NUCLEAR PROBE COMPARED WITH OTHER SOIL MOISTURE MEASUREMENT METHODS. U.S. Forest Serv. Calif. Forest and Range Expt. Sta. Forest Res. Notes 146, 5 pp. Jan. 1959. 1.9 F7626R

The use of the nuclear probe was compared with other soil moisture measurement methods.

801. Merriam, R. A. MOISTURE SAMPLING IN WILDLAND SOILS WITH A NEUTRON PROBE. Iowa State J. Sci. 34(4): 641-648. 1960. 470 Lo9

The neutron probe provides soil scientists and others a research tool that can take its place with gravimetric sampling, electrical resistance techniques, and tensiometers as a "standard" method in soil moisture studies. Some advantages of this technique are: (1) Sampling is limited only by the depth to which access tubes are installed; (2) successive samples can be taken from the same point and additional samples at intermediate points may be made if desired; and (3) one calibration curve suffices for a wide variety of soils.

802. Merriam, R. A. USEFUL STATISTICAL GUIDES AND GRAPHS FOR NEUTRON PROBE SOIL MOISTURE SAMPLING. Intermountain Forest and Range Expt. Sta. Res. Paper 62, 9 pp. 1962. A99.9 F764U

Neutron probes are becoming a standard tool for measuring soil moisture.

Functioning of probes depends on the emission of fast neutrons from a radioactive source placed within the soil profile and the subsequent occurrence and detection of slow or thermal neutrons. These slow neutrons are created by the collision of fast neutrons with hydrogen nuclei. Because the bulk of the hydrogen nuclei in soils is contained in the soil water, the rate at which slow neutrons are created is a measure of soil moisture.

Many users and potential users of neutron probes believe in the desirability of longer counting times at low soil moisture than at high moisture. This is not true when errors in terms of soil moisture were considered rather than errors in counting rate.

803. Merriam, R. A., and Copeland, O. L. COMMENTS ON NEUTRON SOIL MOISTURE PROBE EFFICIENCY AND SENSITIVITY. Soil Sci. Soc. Amer. Proc. 27(1): 106-107. Jan./Feb. 1963. 56.9 So3

Comments were given on neutron soil moisture probes efficiency and sensitivity.

804. Meylan, B. A. MEASUREMENT OF SOIL MOISTURE AND DENSITY BY NEUTRON AND GAMMA-RAY SCATTERING. New Zeal. Dept. Sci. and Indus. Res. Soil Bur. B. 25, 190-191 pp. 1962. 56.9 N483

A report was given on the measurement of soil moisture and density in New Zealand by the neutron and gamma ray scattering method.

805. Mickelson, R. H., Benz, L. C., Carlson, C. W., and Sandoval, F. M. JETTING EQUIPMENT AND TECHNIQUES IN A DRAINAGE AND SALINITY STUDY. Trans. ASAE 4(2): 222-223, 225, 228. Ref. 1961. 290.9 Am32T

A report was given on jetting equipment, techniques, and applications used in a drainage and salinity study in North Dakota. The methods described were found rapid and relatively inexpensive for obtaining soil and ground water information. Jetting techniques were used to install piezometers and small diameter observation wells.

806. Milanov, T. THE APPLICATION OF THE NEUTRON METHOD FOR SOIL MOISTURE MEASUREMENTS AT SMHI. [Sveriges Meterologiska och Hydrologiska Institut]. (Sw) Grundforbattring. 16(4): 284-287. 1963. 54.8 G92
English summary, pp. 294.

A report was given on the application of the neutron method of soil moisture measurement in Sweden.

807. Miljkovic, N., Ayers, A. D., and Eberhard, D. L. SALT-AFFECTED SOILS OF YUGOSLAVIA. Soil Sci. 88(1): 51-55. 1959. 56.8 So3

A report was given on some salt-affected soils in Yugoslavia.

808. Miller, D. E. LATERAL MOISTURE FLOW AS A SOURCE OF ERROR IN MOISTURE RETENTION STUDIES. Soil Sci. Soc. Amer. Proc. Note 27, pp. 716-717. Nov./Dec. 1963. 56.9 So3

In moisture-retention studies on some soils, such as those with inhibiting layers in the profile, lateral flow of soil moisture following irrigation may be a source of error. This error may be excessive if small plots are used. For example, estimates of available water near the end of the observation periods in the 6- to 12-inch depth of the Ephrata and Scooteney soils, based on data from nonisolated plots, are only about 60 percent of the values estimated on plots where lateral flow was prevented.

The amount of error due to lateral flow will be influenced by the existing soil moisture conditions.

809. Miller, D. E. ESTIMATING MOISTURE RETAINED BY LAYERED SOILS. J. Soil and Water Conserv. 19(6): 235-237. Nov./Dec. 1964. 56.8 J822

Estimates were made of the moisture retention characteristics of soils underlain by coarse layers. They were based on the unsaturated conductivity characteristics of the coarse material and the desorption characteristics of the overlying soil.

810. Miller, D. E., and Bunger, W. C. MOISTURE RETENTION BY SOIL WITH COARSE LAYERS IN THE PROFILE. Soil Sci. Soc. Amer. Proc. 27: 586-589. 1963. 56.9 So3

The effects of coarse strata on the moisture retention characteristics of soil profiles were evaluated. A sandy loam soil was underlain at various depths by sand or gravel and the moisture status of the soil was observed for 2 months following a heavy irrigation.

The moisture retained by soil underlain by sand or gravel was much greater than in similar depths of a uniform soil. The moisture content of the soil above a layer increased as the layer was approached. The moisture content of the soil underlain by sand or gravel changed very little after the first few days following irrigation whereas in the uniform soil moisture moved downward throughout the observation period.

The moisture retention characteristics of the profiles were roughly estimated from laboratory measurements of unsaturated conductivities of the sand and gravel and from a moisture characteristic curve of the soil.

811. Miller, D. E., and Gardner, W. H. WATER INFILTRATION INTO STRATIFIED SOIL. Soil Sci. Soc. Amer. Proc. 26(2): 115-119. Mar./Apr. 1962. 56.9 So3

A laboratory investigation was reported on the effects of textural and structional stratification within the profile on rate of water infiltration into the soil.

812. Minashina, N. G. SECONDARY SOLONCHAKS IN ANCIENT IRRIGATED OASES. (Rus) Pochvovedenie 3: 36-50. Ref. Mar. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 3: 230-240. Ref. Mar. 1963. 57.8 P34Ae

A report was given on the formation of secondary solonchaks in ancient irrigated oases.

813. Misono, S. ON THE pF MOISTURE CURVE OF PADDY SOIL. (Ja) J. Sci. Soil and Manure. 35(2): 61-64. Feb. 1964. 56.8 J27
English abstract—Soil Sci. and Plant Nutr. 10(4): 46. 1964. 56.8 So38

The pF moisture curve was given for 8 paddy soils in Japan.

814. Misono, S., and Shimomura, K. ON THE MEASUREMENT OF SOIL MOISTURE BY ELECTRICAL RESISTANCE METHOD. COMPARISON OF 2 TYPES OF ELECTRICAL SOIL MOISTURE METER. (Ja) J. Sci. Soil and Manure. 29(10): 454-456. Jan. 1959. 56.8 J27

815. Moar, N. T. PEAT ON MOKAI PATEA, RUAHINE RANGE, NORTH ISLAND, NEW ZEALAND. New Zeal. J. Sci. and Technol. A, Agr. Res. Sect. 37: 419-426. Feb. 1956. 514 N48A

A study was made of peat formation on North Island in New Zealand.

816. Molodtsov, V. A. SALT CONTENT IN SOILS AND CHANGE IN GROUND LEVEL UPON IRRIGATION OF NEW LANDS IN THE GOLODNAYA STEPPE. (Rus) Pochvovedenie. 1: 12-18. Ref. Jan. 1964. 57.8 P34
English Translation—Soviet Soil Sci. 1: 7-11. Ref. Jan. 1964. 57.8 P34Ae

A report was given on the salt content in soils and changes in ground water level upon irrigation of new lands in the Glodnaya Steppe in the U.S.S.R. The use of drainage for salinity control in the summer was stressed.

817. Morrison, M. E. S. THE WATER BALANCE OF THE RAISED BOG. Irish Nat. J. 11: 303-308. Ref. July 1955. 410 Ir42

A report was given on peat formation in Ireland depending on the water balance of the bog.

818. Mortier, P., and Boodt, M. De. DETERMINATION OF SOIL MOISTURE BY NEUTRON SCATTERING. Netherlands J. Agr. Sci. 4: 111-113. Feb. 1956. 12 N3892

The use was reported of the neutron scattering method in the Netherlands to determine soil moisture.

Fair to good success was obtained with the different soils.

819. Mortier, P., Boodt, M. De, Dansercoer, W., and Leenheer, L. De. THE RESOLUTION OF THE NEUTRON SCATTERING METHOD FOR SOIL MOISTURE DETERMINATION. Internatl. Cong. Soil Sci. Trans. 7(I): 321-329. 1960. 56.09 Tn84T

The resolution of a source-detector assembly to measure soil moisture by neutron scattering depends on the dimensions of the detector, on the location of the source with respect to the detector and on the moisture content of the soil. It was shown experimentally that by the use of an auxiliary moderator of suitable dimensions the resolution can be substantially improved.

820. Motomura, S., and Yamanaka, K. STUDIES ON THE GLEY FORMATION OF SOILS. IV. DEVELOPMENT OF REDUCED SOIL COLOR IN RELATION TO FERROUS IRON. (Ja) J. Sci. Soil and Manure. 34(11): 428-432. Ref. Nov. 1963. 56.8 J27
English summary—Soil Sci. and Plant Nutr. 10(3): 46. May 1964.

A report was given on some studies of the reduced soil color in relation to ferrous iron in poorly drained soils in Japan.

821. Moustafa, A. E. H. I., and El Shabisi, A. I. THE EFFECT OF GYPSUM AND GYPSUM PLUS ORGANIC MATTER ON THE CHEMICAL AND PHYSICAL PROPERTIES OF THE BLACK ALKALINE SOILS IN EGYPT. Egypt. Min. Agr. B. 286, 47 pp. 1959. 24 Eg93

A report was given on the effect of gypsum and gypsum plus organic matter on the chemical and physical properties of the black alkaline soils in Egypt.

The physical and chemical properties of the soil were improved by the addition of gypsum. The improvement was increased with each increment of gypsum and was limited to the layer in which gypsum was added. It was advisable to apply the gypsum deeply with the use of a subsoiler.

822. Mukhin, L. M., and Chistotinov, L. V. GAMMA-RAY METHOD OF MOISTURE DETERMINATION IN COARSE FRAGMENTARY SOILS. (Rus) Pochvovedenie. 1961(7): 122-124. July 1961. 57.8 P34 English summary.
English Translation—Soviet Soil Sci. 7: 807-809. July 1961. 57.8 P34Ae

The use was reported of the gamma ray method for determining soil moisture in coarse fragmentary soils in the U.S.S.R.

823. Muradov, A. S. QUANTITATIVE DISCHARGE OF SALTS BY DRAINAGE WATERS IN MUGAN-SALYANY AREA. (Rus) Akad. Nauk Azerb. SSR. Dok. 19(7): 51-55. 1963. 511 Ak147D

824. Murr, L. THE VARIATION OF DIELECTRIC PROPERTIES OF SOIL AS A FUNCTION OF AVAILABLE MOISTURE. Pa. Acad. Sci. Proc. 36: 185-193. 1962, pub. 1963. 500 P383

A report was given on the equipment for performing dielectric measurements on soil. If the soil moisture is kept high, the dielectric variations due to the soil may be neglected in computing the potential gradient in the growth region.

825. Murray, J. M., and Shanmugham, C. R. FIELD AND LABORATORY DETERMINATION OF FIELD CAPACITY. Canad. Agr. Engin. 6(1): 26-28. Ref. Jan. 1964. 58.8 C164

A report was given on field and laboratory determinations of field capacity in Canadian soils. A method for field capacity of soils where crops were growing was proposed. The method consists of plotting the measured soil moisture depletion against the estimated consumptive use rate and determining the soil moisture content when the two are equal.

826. Myers, L. E., and Van Bavel, C. H. M. MEASUREMENT AND EVALUATION OF WATER TABLE ELEVATIONS. Cong. Irrig. and Drain. Trans. 5(5): R.17.109-R.17.119. Ref. 1963. 55.9 C7652

A report was given on the measurement and evaluation of water table elevations. The authors summarized that the significance of water table data is often limited both in hydrology and in physical edaphology. The significant factor in both types of problems is the degree of saturation which exists throughout the soil profile and this is not related in any simple way to the water table.

827. Myers, V. I., Langan, L. N., and Lloyd, R. D. INTERPRETATIVE SOIL GROUPINGS FOR ANALYSIS OF DRAINAGE PROBLEMS IN WESTERN IRRIGATED AREAS. Trans. ASAE 5(1): 103-105. Ref. 1962. 290.9 Am32T

A report was given on the use of interpretative soil groupings for analyzing drainage problems in western irrigated areas for designing drainage systems. The most economical water table control plan was discussed for use where alternative methods are available.

828. Naas, O. AN APPARATUS FOR THE STUDY OF WATER RELATIONS IN THE SOIL. (Sw) Grundforbattring. 10(2): 152-153. 1957. 54.8 G92

829. Nathan, K. PIEZOMETERS AND WELLS FOR WATER TABLE STUDY. N.J. Agr. 43(2): 13-15. Mar./Apr. 1961. 275.28 N46

A report was given on the use of piezometers and wells to study water table depths in New Jersey for the design of drainage systems.

830. Nelson, R. W. AUGER-HOLE, PIEZOMETER AND TWO-HOLE METHOD IN IDAHO. Agr. Engin. 40(5): 271. May 1959. 58.8 Ag83

A comparison was reported in Idaho of the use of the auger hole method, piezometer, and two-hole method for measuring hydraulic conductivity of the soil for the design of drainage systems.

831. Nelson, R. W. IN-PLACE MEASUREMENT OF PERMEABILITY IN HETEROGENEOUS MEDIA: I. THEORY OF A PROPOSED METHOD. J. Geophys. Res. 65(6): 1735-1738. June 1960. 470 J823

A method for in-place measurement of permeability in heterogeneous, saturated soils was presented. The method is based upon a general theory presented in three dimensions for saturated flow in a heterogeneous medium.

832. Nemchinov, A. A. THE BOG PROCESS AND ITS MANIFESTATION IN THE SOD-PODZOL ZONE. (Rus) Leningrad. TSent. Muz. Pochvoved. im. V. V. Dokuchaeva. Sborn. Rabot. 1957(2): 57-101. Ref. 1957. 56.9 L544

833. Neuwinger-Raschendorfer, I. SOIL MOISTURE MEASUREMENT. (Ge) Mitt. der Forstl. Bundes-Versanst. Mariabrunn. 59: 257-264. Ref. 1961. 99.8 M69

834. Nicholson, R. WATER MOVEMENT IN A SANDY SOIL. Oxford U. Forest Soc. J. 4(5): 17-21. 1957. 99.9 Ox2

The movement of available water in a freely-draining sandy woodland soil was studied by means of "porous pencils".

After a period of rain followed by dry weather, "peaks" of available moisture were recorded in successively deeper layers of the soil. The "waves" of moisture passing through the soil were sometimes merely narrow bands, less than 6 inches thick. The movement was more rapid in moist soil dry soil.

835. Nielsen, D. R. MOVEMENT OF WATER IN UNSATURATED SOILS AS RELATED TO SOIL PHYSICAL PROPERTIES. Diss. Abs. 19(8): 1883-1884. Feb. 1959. 241.8 M58

The rapid redistribution of soil water immediately following infiltration was studied in four Iowa soils. The observed redistribution of water within these soils were explained on the basis of soil physical properties.

836. Nielsen, D. R., Biggar, J. W., and Miller, R. J. SOIL PROFILE STUDIES AID WATER MANAGEMENT FOR SALINITY CONTROL. Calif. Agr. 18(8): 4-5. Aug. 1964. 100 C12Cag

A report was given on the value of soil profile studies to aid water management for salinity control in California.

837. Nielsen, D. R., Davidson, J. M., Biggar, J. W., and Miller, R. J. WATER MOVEMENT THROUGH PANOCHE CLAY LOAM SOIL. Hilgardia. 35(17): 491-506. 1964. 100 C12H

Water movement through Panoche clay loam was explained on the basis of the soil-water properties within the profile. Laboratory-determined soil water content-tension relations from 3-inch cores taken from the field every 6 inches to 5 feet provided reliable estimates of soil water behavior.

838. Nielsen, D. R., Kirkham, D., and Perrier, E. R. SOIL CAPILLARY CONDUCTIVITY: COMPARISON OF MEASURED AND CALCULATED VALUES. Soil Sci. Soc. Amer. Proc. 24(3): 157-160. 1960. 56.9 So3

Measured and calculated capillary conductivity values were compared for core samples taken from agricultural soil in the field. The calculated values were obtained from: (1) A theory of Childs and Collis-George; and (2) the theory of Marshall.

839. Nielsen, D. R., Kirkham, D., and Wijk, W. R. Van. MEASURING WATER STORED TEMPORARILY ABOVE THE FIELD MOISTURE CAPACITY. Soil Sci. Soc. Amer. Proc. 23(6): 408-412. Nov./Dec. 1959. 56.9 So3

Using a neutron type soil moisture meter, amounts of water temporarily stored in soil profiles above the field moisture capacity were observed for two silt loams and two clay loams in Iowa. The amounts of temporarily stored water for the 5-foot depth, ranged from 4.7 inches of one of the silt loams to 2.1 inches for one of the clay loams, immediately after 6 inches of irrigation water had penetrated the soil. After 90 hours, temporarily stored water ranged from 1.5 inches to 0.3 inches.

840. Nijensohn, L. ELECTRICAL CONDUCTIVITY POTENTIAL. (Sp) Mex. Dir. Gen. de Dist. de Riego. Dept. de Planeacion, Invest. y Estadis. Memo. Tec. 161, 16 pp. May 1960. 292.9 M572

841. Nijensohn, L. A NEW METHOD FOR THE DETERMINATION OF THE ELECTRICAL CONDUCTIVITY OF SOIL EXTRACTS AND IRRIGATION AND DRAINAGE WATERS. Internatl. Cong. Agr. Engin. Trans. 5(1): 562-569. 1958, pub. 1960. 290.9 C765C

A new chronothermometric method was proposed for determining the electrical conductivity of irrigation and drainage waters.

842. Nikolaev, A. V. METHOD FOR QUICK DETERMINATION OF SOIL MOISTURE. (Rus) Sel'sk. Khoz. Tadzhikistana. 8: 28-29. Aug. 1962. 20 Se494

843. Nikonov, M. N., and Golgofskaia, G. V. THE REPUTED PEAT SUPPLY ON THE EUROPEAN RSFSR. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 75-87. 1957. 56.33 R922

844. Nitsenko, A. A. MAIN CONCEPTS OF BOG SCIENCE AND THEIR CLASSIFICATION. (Rus) Bot. Zhur. [Moscow] 47(7): 945-956. Ref. July 1962. 451 R923
English summary.

A critical review was given of different views on the main concepts of bog science and bog classification.

845. Nixon, P. R., and Lawless, G. P. TRANSLOCATION OF MOISTURE WITH TIME IN UNSATURATED SOIL PROFILES. J. Geophys. Res. 65: 655-661. Feb. 1960. 470 J823

Downward translocation of moisture in soil profiles under various types of natural vegetation and a denuded plot was observed during a prolonged rainless period. Moisture determinations were made to 20-foot depths with a neutron-scattering moisture meter. Under favorable conditions, moisture translocated downward in unsaturated soil may contribute to ground water recharge.

846. Nixon, P. R., and Lawless, G. P. DETECTION OF DEEPLY PENETRATING RAIN WATER WITH NEUTRON-SCATTERING MOISTURE METER. Trans. ASAE 3(1): 5-8. 1960. 290.9 Am32T

The advantages of using the neutron-scattering moisture meter in hydraulic studies were enumerated.

847. Nosenkov, A. I. DETERMINATION OF INFILTRATING CAPABILITY OF SOILS. (Rus) Lesn. Khoz. 6: 18-21. June 1964. 99.8 L5622

848. Novak, B., and Franklova, S. CONTRIBUTION TO THE KNOWLEDGE OF DYNAMICS OF LYSIMETRIC VALUES OF SOIL AND OF SAND AT TIME OF FERTILIZING WITH ORGANIC FERTILIZERS. (Cz) Czechoslovakia Min. Zemedel. Lesn. a Vodniho Hospodar. Ust. Vedtech. Inform. Rostlinna Vyroba. 9(5): 487-500. Ref. May 1963. 64.9 C33
French summary.

849. Obrejanu, G., Maiana, A., and Axenova, I. SALT ACCUMULATION IN THE SALINE AND ALKALI SOILS OF THE RIVER VALLEYS OF THE RUMANIAN PLAIN. (Rum) Solului. 2: 31-40. Ref. 1964. 56.8 St5
English summary, pp. 93.

A discussion was given on salt accumulation in the soils and ground waters in the river valleys in Rumania.

850. Obrejanu, G., and Sandu, G. CLASSIFICATION OF SOIL WITH A VIEW TO THE FORMULATION OF DAMMING UP AND DRAINAGE PROGRAMS. (Rum) Prob. Agr. [Bucharest] 15(1): 31-44. Ref. Jan. 1963. 21 R862
French summary.

851. Ochiai, T. MEASUREMENT OF GROUND WATER VELOCITY AND ITS DIRECTION OF FLOW BY THE USE OF RADIOISOTOPE FLOW METER. Internatl. Comn. Irrig. and Drain. Annu. B. 1964: 39-41. 1964. 55.9 In8A

A report was made of the measurement of ground water velocity and its direction of flow by the use of a radioisotope flow meter in Japan.

852. Oganesian, A. P. A SIMPLIFIED METHOD FOR DETERMINING SOIL MOISTURE. (Rus) Pochvovedenie. 1958(4): 109-113. Ref. Apr. 1958. 57.8 P34
English translation—Soviet Soil Sci. 4: 446-449. Ref. Apr. 1958. 57.8 P34Ae

An alcohol method of determining soil moisture was given and compared with other methods.

853. Okruszko, H. PEAT LANDS OF TERRITORIES OF THE OMULEW RIVER BASIN. (Pol) Rocz. Nauk Roln. Ser. A, Roslinna. 71: 407-441. 1955. 20.5 R59
English summary.

A report was given on the peat lands occurring on territories of the Omulew—River Basin in Poland. A general characterization was given of the whole basin from a geomorphological, hydrographical, soil, climate, and economic standpoint.

Methods of proper melioration of peat lands were based on the specificity of each of the peat types.

854. Okruszko, H., and Churski, T. THE RELATION BETWEEN THE KIND OF PEATLAND AND THE GEOMORPHOLOGY OF SOIL ON AN EXAMPLE OF THE NOTEC RIVER VALLEY. (Pol) Rocz. Nauk Roln. 75-F-2: 371-392. maps. Ref. 1962. 20.5 R59
English summary.

A report was given on the genesis of some peat soils in the Nortec River Valley in Poland due to the effect of relief on the formation of specific kind of peat layers. A thorough knowledge of the peatlands and their classification was stressed before planning drainage for the area.

855. Olenin, A. S. DEVELOPMENT AND METHODICAL PRINCIPLES OF CARTOGRAPHY OF PEAT DEPOSITS IN USSR. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 54-74. 1957. 56.33 R922

856. Olkowski, M. GYTTJA SOILS ARE DIFFICULT TO DRAIN. (Pol) Wiad. Melior. i Lakarskie. 6(1): 26-27. Jan./Feb. 1963. 54.8 W63

857. Olszewski, Z. THE PROCESS OF BOG SOIL FORMATION. (Pol) Rocz. Nauk Roln. Ser. A, Roslinna. 75-A-1: 141-158. Ref. 1957. 20.5 R59
English summary.

The process of bog soil formation in Poland was discussed and a classification of, and description of the bog soil types were given.

858. Onchukov, D. N. DETERMINATION OF MOISTURE OF FRIABLE SUBSTANCES BY ELECTRO-CONDUCTIVITY. (Rus) Pochvovedenie. 1961(3): 95-98. Ref. Mar. 1961. 57.8 P34
English Translation—Soviet Soil Sci. 3: 319-321. Ref. Mar. 1961. 57.8 P34Ae

A report was given on soil moisture measurement in the U.S.S.R. by means of electro-conductivity.

859. Orlob, G. T., and Butler, R. G. SOIL LYSIMETERS IN WASTE WATER RECLAMATION STUDIES. Amer. Soc. Civil Engin. Trans. 123: 116-136.

Interest in waste water reclamation by surface spreading has dictated a need for study of the mechanism of infiltration, the phenomena that determine the rates of water percolation, and the interaction of porous media and degraded waters. Soil lysimeters were shown to be well suited for the investigation of many important aspects of the reclamation problem and to offer a convenient, economical means of predicting full-scale field spreading performance.
With discussion by Messrs. Ralph Stone; and Gerald T. Orlob and Robert G. Butler, pp. 137-138.

860. Orlovskii, N. V. INVESTIGATIONS ON THE GENESIS, SALT REGIME, AND RECLAMATION OF SOLONETZ AND OTHER SALINE SOILS OF BARABA LOWLAND. (Rus) Poch. Inst. im. V. V. Dokuchaeva. Trudy. 47: 226-409. Ref. 1955. 56.9 P44

861. Osborn, J. F., and Pelishek, R. E. INSTALLING DEEP NEUTRON ACCESS TUBES. Agr. Engin. 42(11): 611. Nov. 1961. 58.8 Ag83

A report was given on the use of a power drill for hard subsoil and rock conditions to install deep neutron access tubes for soil moisture measurement.

862. Oyama, M. A. A CLASSIFICATION SYSTEM OF PADDY RICE FIELD SOILS BASED ON THEIR DIAGNOSTIC HORIZONS. (Ja) Tokyo Natl. Inst. Agr. Sci. B. Ser. B (Soils and Fert.) 12: 303-372. Ref. Feb. 1962. 56.9 C432
English summary.

A report was given on the classification of paddy rice fields in Japan based on their horizons.

863. Paavilainen, E. ON WATER CONTENT OF PEAT AND GROUND WATER LEVEL. (Fi) Suo. 14(1): 8-9. May 6, 1963. 54.8 Su7
English summary.

A report was given of the water content of peat soils as influenced by the ground water level in Finland.

864. Pair, C. H., and Lewis, G. C. CHEMICAL AND INTAKE-RATE CHANGES WITH VARIOUS TREATMENTS ON SEBREE-CHILCOTT SOIL SERIES ASSOCIATION (SLICK SPOTS). Soil Sci. 90: 306-311. 1960. 56.8 So3

Methods of improving the intake rates in the soil were studied. The application of gypsum to Sebree (slick spot) soils increased the intake rate from 0.01 inch per hour to 0.10 inch per hour for a 10-ton-per-acre application and to 0.22 inch per hour where a 20-ton-per-acre application was made. The mixing of the Sebree soil profile to a depth of 4 feet increased the intake rate from 0.01 to 0.42 inch per hour.

Both mixing and the application of gypsum raised the intake rate of the Sebree soil to the level of the associated Chilcott soils and will result in better irrigation of these associated soil types.

Both treatments reduced the exchangeable sodium, but the mixing treatment was the more effective in removing the excess of soluble salts.

865. Panteleeva, N. N. PRESENT METHODS OF RESEARCH ON DISCOVERY OF LANDS SUITABLE FOR DRAINAGE. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 117-123. 1962. 20 M857

866. Papp, B. SOIL MOISTURE MEASUREMENT WITH GAMMA RAY EQUIPMENT. (Hu) Idojaras. 66(4): 222-234. July/Aug. 1962. 340.8 Id5
English summary.

The theory of the gamma ray soil moisture measurements was discussed. A description was given of the instruments used in Hungary.

867. Parr, J. F., and Bertrand. WATER INFILTRATION INTO SOILS. Adv. Agron. 12: 311-363. Ref. 1960. 30 Ad9

A review of the literature and a discussion were given on water infiltration into soils.

868. Patrick, W. H., Jr., Wyatt, R., and Brupbacher, R. H. A STUDY OF CHEMICAL AND PHYSICAL PROPERTIES OF THREE ALLUVIAL SOILS IN THE SUGAR CANE AREA OF LOUISIANA. La. Agr. Expt. Sta. B. 580, 19 pp. 1964. 100 L96

A study was made of certain physical and chemical properties of the A_p horizon of three important soil series of alluvial origin in the sugar cane area of Louisiana.

The better drained Cypremort soils, occurring at the highest elevations and closest to the stream channel, had the coarsest texture, lowest organic matter content, and the lowest aggregation. They also contained the lowest levels of mineral nutrients. The very poorly drained and fine-textured Iberia soils, occurring farthest from the channel at the lowest elevations was highest in organic matter, percent aggregation, and content of mineral nutrients. The Baldwin soils, generally lying between the Cypremort and Iberia soils, were intermediate in physical properties and extractable nutrients. An exception to this pattern was extractable potassium which was slightly higher in the Baldwin soils than in the Iberia soils.

869. Peele, T. C., and Beale, O. W. LABORATORY DETERMINATION OF INFILTRATION RATES OF DISTURBED SOIL SAMPLES. Soil Sci. Soc. Amer. Proc. 19: 429-432. 1955. 56.9 So3

A procedure for determining infiltration rates of disturbed soil samples in the laboratory, using simulated rainfall, was described. Data showing the relation of laboratory infiltration rates to those measured on cultivated areas in the field were presented. Comparisons of runoff from natural storms with infiltration rates determined in the laboratory and the field were given for several soil types. The laboratory infiltrometer, the type-F field infiltrometer, and infiltration during natural storms placed the different soils in the same order. The usefulness of the laboratory infiltrometer for evaluating the effects of rotations, chemical soil conditioners, and inherent soil properties on infiltration in the surface soil of clean-cultivated areas was briefly discussed.

870. Peerlkamp, P. K. EVAPORATION RESEARCH WITH FOUR DRAINAGE-LYSIMETER PLOTS IN THE ROTTEGATSPOLDER (NETHERLANDS). Internatl. Comn. Irrig. and Drain. Annu. B. 1955: 95-100. 1955. 55.9 In8A

Results of evaporation research with four drainage-lysimeter plots in the Rottegatspolder in the Netherlands were given. It was concluded that the evaporation of the drainage-lysimeter field was in rather good agreement with that of the entire polder.

871. Pereira, H. C. MOISTURE MEASUREMENTS IN EAST AFRICAN SOILS. Inter-African Soils Conf. Proc. 2: 425-430. 1954. 56.09 In846

Techniques were discussed for the measurement of soil moisture storage under East African conditions.

Electrical resistance units were necessary to record the duration of free drainage and to indicate the times at which moisture samples should be taken. Calibration of the individual resistance units were unnecessary for these purposes.

872. Perekhrest, S. M. MARSHES OF CUBA AND POSSIBILITIES OF THEIR UTILIZATION. (Rus) Gidrotekh. i Melior. 8: 49-59. map. Aug. 1963. 290.8 G362

873. Pershina, M. N. CLASSIFICATION AND DIAGNOSTIC INDICES OF SOLONCHAK SOILS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 89: 134-139. 1963. 20 M857

874. Peters, D. D., and Bartelli, L. J. SOIL MOISTURE SURVEY OF SOME REPRESENTATIVE ILLINOIS SOIL TYPES. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-21, 40 pp. 1958. A56.9 R31

Basic soil moisture characteristics of some representative soils in Illinois were reported. Thirty soil types in 22counties were sampled. Selected types represented soils of the Gray Brown Podzolic, Brunizems, Planosols, Humic Gley, and Alluvial Great Soil Groups. An attempt was made to sample sites where a moderately high level of management was practiced.

875. Petrov, E. G., and Shishov, L. L. SOIL LYSIMETERS FROM PLASTIC MATERIALS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 76: 135-141. 1962. 20 M857

876. Phillips, R. E., Jensen, C. R., and Kirkham, D. USE OF RADIATION EQUIPMENT FOR PLOW-LAYER DENSITY AND MOISTURE. Soil Sci. 89(1): 2-7. Jan. 1960. 56.8 So3

The use of radiation equipment for plow-layer density and moisture was compared with results of core-sample determinations.

877. Phillis, E. PROFILES AND PERMEABILITY IN MALAYAN PADI SOILS. Malayan Agr. J. 44(1): 3-17. 1963. 22.5 F312

An investigation was reported on the profile characteristics of Malayan rice soils and their permeability to water in the flooded state.

878. Pol'skii, M. N. METHODS OF TREATMENT, DRAWING AND ANALYSING DATA ON SOIL MOISTURE DYNAMICS. (Rus) Pochvovedenie. 1958(11): 72-82. Ref. Nov. 1958. 57.8 P34
English Translation—Soviet Soil Sci. 11: 1255-1265. Ref. Nov. 1958. 57.8 P34Ae

Several methods for taking and analyzing moisture dynamics were suggested for studying the moisture consumption and the moisture supply of plants. Several methods were designed for using both biological and soil hydrological data.

879. Pons, L. J. GEOLOGY, SOIL FORMATION AND HISTORY OF THE DRAINAGE CONDITIONS IN THE LAND VAN MAAS EN WAAL AND A PART OF THE RIJK VAN NIJMEGEN. (Du) Netherlands Dir. van de Landb. Verslagen van Landbk. Onderz. 63(11): 1-156. maps. Ref. 1957. 105.2 V61V
English summary.

Geology, soil formation, and history of drainage for land in the Van Maas En Wall and Rijk Van Nijmegen areas in the Netherlands were discussed. Since its beginning in the 14th century, the following land drainage methods have been used: (1) Natural drainage into a basin area and into the river; (2) drainage directly into a river by a lock; and (3) drainage in combination with other polders.

880. Pons, L. J. SOIL GENESIS AND CLASSIFICATION OF RECLAIMED PEAT SOILS IN CONNECTION WITH INITIAL SOIL FORMATION. Internatl. Cong. Soil Sci. Trans. 7(IV): 205-211. 1960. 56.09 In847T

The peat formation and the origin of the peat has been regarded as a geogenetic process (A_{00}G-profile). Pedogenesis begins at the moment that the peat swamp is drained. The initial soil formation processes are distinguished as: Physical (dehydration, stiffening, compaction and fracture of the peat mass); chemical (breakdown of carbohydrates and proteins and a comparative enrichment of mineral particles); and biological (mechanical reduction and mixing of the peat material by soil fauna, ultimately developing a fairly homogeneous moulded layer (so-called organic A_1).

After these ripening processes the progressive soil formation processes, viz: the formation of a distinct organic A_1 (mull A_1 or moder A_1) and an organic B (accumulated dispersed humus) occur.

Based on the knowledge referred to the organic soils have been classified.

881. Popov, O. V. LYSIMETERS AND HYDRAULIC SOIL EVAPORIMETERS. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 26-37. Ref. 1959. 292.9 As7C

A report was given on the use, in the U.S.S.R., of lysimeters and hydraulic soil evaporimeters.

882. Popp, N. MARSHES AND PEAT-BOGS IN THE DANUBE DELTA. (Rum) Celuloza so Hirtie. 11(3): 81-90. map. Mar. 1962. 209.8 C334
English summary.

A report was given on the genesis of marshes and peat bogs in the Danube Delta in Rumania.

883. Postlethwaite, J. D., and Trickett, E. S. THE MEASUREMENT OF SOIL MOISTURE. J. Agr. Engin. Res. 1: 89-95. Ref. 1956. 58.8 J82

A simple method was described for the manufacture of a small moisture sensitive unit for the measurement of soil moisture. The block uses nylon encased in stainless steel and surrounded with a thin skin of plaster to act as a buffer.

884. Pratt, P. F., and Chapman, H. D. GAINS AND LOSSES OF MINERAL ELEMENTS IN AN IRRIGATED SOIL DURING A 20-YEAR LYSIMETER INVESTIGATION. Hilgardia. 30(16): 445-467. 1961. 100 C12H

The data from a 20-year lysimeter investigation with an irrigated soil (Holland loam) were presented and discussed.

885. Prenk, J. SURVEYS ON THE STATE OF LYSIMETER MEASUREMENTS IN GERMANY. (Ge) In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 166-169. Ref. 1959. 292.9 As7C

886. Principi, P. SALINE SOILS IN AGRICULTURE. (It) Italia Agr. 93: 542-553. Aug. 1956. 16 Itl

887. Pruitt, W. O., and Angus, D. E. LARGE WEIGHING LYSIMETER FOR MEASURING EVAPOTRANSPIRATION. Trans. ASAE 3(2): 13-15, 18. 1960. 290.9 Am32T

A large weighing lysimeter used in California for measuring evapotranspiration was described and illustrated.

888. Przesmycki, J. ISOTOPIC MEASUREMENT OF SOIL MOISTURE. (Pol) Warsaw Panst. Inst. Hydrol-Met. Gaz. Obserw. P.I.H.M. 16(6): 9-11. June 1963. 345 W26G

889. Przestalski, S. MEASUREMENT OF MOISTURE AND POROSITY OF SOIL BY GAMMA RAYS. (Pol) Wroclaw. Wyzsza Szkola Roln. Zeszyty Nauk. Roln. 8: 87-95. 1959. 20.5 B75
English summary.

A discussion was given on the measurement of soil moisture and soil porosity by gamma rays in Poland.

890. Przestalski, S. CRITICAL REMARKS ON MEASUREMENTS OF SOIL MOISTURE WITH THE METHOD OF POROUS PROBES. (Pol) Wroclaw. Wyzsza Szkola Roln. Zeszyty Nauk. Roln. 9: 135-152. Ref. 1959. 20.5 B75
English summary.

A report was given of the difference between practice and theory in Poland of the plaster of paris blocks (introduced by Bouyoucos) for measuring soil moisture under field conditions.

891. P'yavchenko, N. I. TYPOLOGICAL CHARACTERISTICS OF SWAMPED FORESTS BEARING ON DRAINAGE WORK. In his THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 7-15. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A classification system was given for swamped forests in the U.S.S.R. as a guide to drainage work. The effect of drainage on the different types were discussed.

892. P'yavchenko, N. I. PEAT BOGS OF THE RUSSIAN FOREST-STEPPE. OTS 64-11011. 156 pp. 1964. 56.33 P57Te

An English translation was given of the publication "Peat Bogs of the Russian Steppe" that was originally published in Russian. The genesis and classification of peat bogs in the U.S.S.R. were discussed along with their physical and chemical properties.

893. Raney, W. A., and Thorne, M. D. THE USE OF RADIOISOTOPES IN SOIL PHYSICS RESEARCH. In ATOMIC ENERGY AND AGRICULTURE. pp. 81-95. 1957. Amer. Assoc. Adv. Sci. Pub. 49: 1-18. 1957. 334 C733

A report was given on the use of radioisotopes in soil physics research for the measurement of soil moisture, soil aeration, soil temperature, and mechanical impedance to root and shoot development.

894. Ranwell, D. C. SPARTINA SALT MARSHES IN SOUTHERN ENGLAND. II. RATE AND SEASONAL PATTERN OF SEDIMENT ACCRETION. AND III. RATES OF ESTABLISHMENT SUCCESSION AND NUTRIENT SUPPLY AT BRIDGWATER BAY, SOMERSET. J. Ecol. 52(1): 79-105. Ref. Mar. 1964. 450 J829

A discussion was given on the genesis of spartina salt marshes in Southern England.

895. Rasmussen, W. W., Lewis, G. C., and Fosberg, M. A. IMPROVEMENT OF THE CHILCOTT-SEBREE (SOLODIZED-SOLONETZ) SLICK SPOT SOILS IN SOUTHWESTERN IDAHO. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-91, 39 pp. 1964. A56.9 R31

Soil improvement investigations were reported on the Chilcott-Sebree (solodized-Solonetz) slick spot soil complex, a principal soil complex representative of relatively large areas of slick-spot-affected soils in southwestern Idaho. Summary descriptions of the Chilcott and Sebree soil series were given in the appendix.

The Chilcott-Sebree soils are typical of the slick-spot-affected soils in the general area. The Sebree slick spot soil, classified as a solodized-Solonetz, is also described chemically as a saline-sodic (alkali) soil.

896. Rauzi, F. WATER INTAKE AND PLANT COMPOSITION AS AFFECTED BY DIFFERENTIAL GRAZING ON RANGELAND. J. Soil and Water Conserv. 18: 114-116. 1963. 56.8 J822

Studies of water intake on rangeland soils were conducted on the Northern Great Plains Field Station, Mandan, N. Dak., during July 1961. The study areas, native range pasture grazed at three different intensities over a long period of time, afforded an unusual opportunity to determine the effect of livestock use on the rate of water intake. The loss of surface cover and heavy use by livestock decreased the rate of water intake. Total water intake on the moderately grazed pasture was 1.6 times as great as on the heavily grazed pastures during the 1-hour test. Water intake on the ungrazed area was 1.8 times as great as on the moderately grazed pasture.

The composition of vegetation on the sites showed marked differences as a result of different histories of grazing. Blue grama was the dominant grass on the heavily grazed pasture. Western wheatgrass and needle-and-thread were more abundant on the moderately grazed pastures.

897. Rauzi, F., and Kuhlman, A. R. WATER INTAKE AS AFFECTED BY SOIL AND VEGETATION ON CERTAIN WESTERN SOUTH DAKOTA RANGELANDS. J. Range Mangt. 14: 267-271. Sept. 1961. 60.18 J82

During the summer months of 1957-58, water-intake studies were conducted on instrumented rangeland watersheds in the 10-14-inch precipitation belt near Newell, South Dakota. Data from four range sites on four watersheds showed that water-intake rates were correlated with range sites, as mapped by SCS, where the range condition class was comparable.

898. Raychaudhuri, S. P., Murthy, R. S., and Sharma, V. D. STUDIES ON SALINE ALKALI SOILS OF INDIA. V. MORPHOLOGY, GENESIS AND CLASSIFICATION OF SOME SALINE ALKALI SOILS OF SOUTH INDIA. Indian J. Agr. Sci. 32(4): 278-287. Ref. Dec. 1962. 22 Ag831

A report was given on the morphology, genesis, and classification of some saline alkaline soils in India.

899. Raychaudhuri, S. P., and Sharma, V. D. STUDIES ON SALINE AND ALKALINE SOILS OF INDIA. I. SOME TYPICAL PROFILES FROM BOMBAY AND MADRAS STATES. Indian Sci. Cong. Assoc. Proc. 41(3, (Abs.)): 240-241. 1954. 513 In22

Chemical and physical properties of saline and alkaline soils in India were given of some typical soil profiles.

900. Raymundo, M. E., Pantastico, E. B., and Manarpaac, V. T. SOME PHYSICAL AND CHEMICAL PROPERTIES OF AN UPLAND SOIL AND ITS ASSOCIATED PADDY SOILS. Philippine Agr. 46(7): 560-569. Ref. Dec. 1962. 25 P542

Physical and chemical properties of an upland soil was compared with its associated paddy soils in the Philippines.

901. Read, D. W. L. HORIZONTAL MOVEMENT OF WATER IN SOIL. Canad. J. Soil Sci. 39(1): 27-31. Ref. Feb. 1959. 56.8 C162

A laboratory experiment was conducted to determine the rate of extraction and the distance water will move in a horizontal radial system. An absorber was placed in the center of a layer of soil 5 cm. deep. Extractions were made from three soils (loam, sand, and clay) which were at soil moisture tensions of zero to 450 cm. of water tension. Water moved to the absorber from at least 14 cm. away. No appreciable soil moisture tension gradients developed in the soil.

902. Reed, L. W. A STUDY OF SALINE-ALKALI SOILS IN OKLAHOMA. Okla. State U. Expt. Sta. Processed Ser. P-430, 37 pp. 1962. 100 Ok4M

Saline and alkali soils occur in many parts of Oklahoma. The chemical characteristics of these soils can be correlated with their morphological properties. The growth of plants on saline-alkali soils is usually impaired by soluble salts and high exchangeable sodium. Reclamation of saline and alkali soils regardless of source of the salines may be accomplished by: (1) Drainage; (2) an abundant supply of high quality irrigation water or rainfall for leaching; (3) adequate cultural practices such as leveling, ponding, and strict adherance to a plan of operation; and (4) soil treatment sufficient to replace soil sorbed sodium with calcium.

The extent and relative severity of saline and alkali soils in Oklahoma, and the origin of the salts and sodium saturated clays were indicated. The effect of saline irrigation water on soil properties and plant growth was reported, and techniques for reclamation of soils damaged by saline irrigation water were suggested.

903. Reeder, S. W., and Odynsky, W. MORPHOLOGICAL AND CHEMICAL CHARACTERISTICS OF THE SOLONETZIC SOILS OF NORTHWESTERN ALBERTA. Canad. J. Soil Sci. 44(1): 22-23. 1964. 56.8 C162

The morphological characteristics and average chemical properties for 69 Solonetzic soils of northwestern Alberta were presented. The chemical data included: Conductivity and soluble salts; exchangeable cations and exchange capacity; pH; organic carbon; and total calcium, magnesium, and sodium.

The soils classified as Solonetz and Solodized Solonetz possessed properties in agreement with the limits proposed for soils of the Solonetzic Order, whereas the soils classified as Solods had chemical properties that placed them in a borderline position with the soils of this Order.

904. Reeve, R. C. RESEARCH ON PERMEABILITY BY THE REGIONAL SALINITY LABORATORY AT RIVERSIDE. U. Calif. Res. Resources Conf. Proc. Davis, Calif., Mar. 19, 1957: 34-35. 1957.

A report was given on results of research on soil permeability conducted at the Regional Salinity Laboratory at Riverside, California.

905. Reeve, R. C. THE TRANSMISSION OF WATER BY SOILS AS INFLUENCED BY CHEMICAL AND PHYSICAL PROPERTIES. Internatl. Cong. Agr. Engin. Trans. 5(1): 21-32. 1960.

Data from investigators on this subject were reviewed and the pertinent information evaluated. Hydraulic conductivity of soils is not constant. For a given soil the hydraulic conductivity may vary several hundredfold with time. An expotential relationship of the type $y = \frac{i}{b}\ln\frac{a}{t}$ (where, t = time after water first emerges from the soil column, y = hydraulic conductivity, i = driving force or gradient, and a and b are constants for each soil) describes the change in hydraulic conductivity with time up to 30 or 40 hours. This time period is of importance in many irrigation and drainage processes.

The exchangeable sodium percentage of the soil and the electrolyte concentration of the water are the primary factors with which the hydraulic conductivity of a given soil varies. Hydraulic conductivity of soil can be expressed in terms of exchangeable sodium percentage as a function of time.

906. Reeve, R. C., and Luthin, J. N. METHODS OF MEASURING SOIL PERMEABILITY. *In* Luthin, J. N. ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 395-445. 1957. 4 Am392

Discussions were given of the problems and methods of measuring soil permeability in both the field and laboratory: for drainage investigation methods.

907. Reginato, R. J., and Van Bavel, C. H. M. SOIL WATER MEASUREMENT WITH GAMMA ATTENUATION. Soil Sci. Soc. Amer. Proc. 28(6): 721-724. Nov./Dec. 1964. 56.9 So3

Gamma-ray attenuation measurement of wet density were made with a 5-mc. Cs-137 source over a pathlength of about 30 cm. Data were reported glass and water systems as well as for soil materials of varying water content.

908. Reineck, H. E. STRUCTURES OF TIDAL FLAT SEDIMENTS. (Ge) Z. F. Pflanzenernahr. Dungung, Bodenk. 99(2/3): 151-153. Nov. 1962. 384 Z343A
English summary.

The structure of tidal flat sediments primarily are due to sedimentation and erosion. Secondary structures are due to burrowing animals like molluses, worms, and crustaceans.

909. Remson, I., and Randolph, J. R. ROOT GROWTH NEAR TENSIOMETER CUPS AS A CAUSE OF DIURNAL FLUCTUATIONS OF READINGS. Soil Sci. 85: 167-171. 1958. 56.8 So3

Large fluctuations did occur, they resulted from the withdrawal of moisture by vegetation rooted on or near the tensiometer cups. It is possible that this might be a contributing cause to the diurnal fluctuations observed in other installations.

910. Reyes, E. D., and Galvez, N. L. LYSIMETER STUDIES ON A LIPA CLAY LOAM GROWN TO PADDY RICE. II. EFFECTS OF FERTILIZATION ON GRAIN YIELDS. Philippine Agr. 45(6): 289-297. Nov. 1961. 25 P542

A report was given on some lysimeter studies on the effect of fertilizers on rice yields in the Philippines.

911. Reynders, J. J. A BRIEF REPORT ON THE OCCURRENCE OF PEAT IN NETHERLANDS NEW GUINEA. Boor en Spade. 12: 27-32. maps. 1962. 56.9 B64

A report was given on peat soils in the Netherlands New Guinea.

912. Rich, L. R. HYDROLOGIC RESEARCH USING LYSIMETERS OF UNDISTURBED SOIL BLOCKS. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 139-145. 1959. 292.9 As7C

A report was given on the Base Rock Lysimeters in central Arizona used to study the surface and percolation flow in relation to precipitation, and vegetational densities in a natural soil mantle.

913. Richards, L. A. PORTABLE CONDUCTIVITY BRIDGE AND CELLS FOR SALINITY APPRAISAL. Soil Sci. 80: 55-59. 1955. 56.8 So3

Electric bridge measurements have long been used for the appraisal of soil salinity, and the U.S. Salinity Laboratory recommends the conductivity of the saturation extract as a salinity index for general agricultural use. A portable vacuum filter and the electric measuring set described were developed to simplify and facilitate this measurement.

914. Richards, L. A. RETENTION AND TRANSMISSION OF WATER IN SOIL. U.S. Dept. Agr. Ybk. Agr. 1955: 144-151. 1955. 1 Ag84Y

A simplified treatment was given to aid in the understanding and the quantitively expressing of the observed phenomena relating to the retention and transmission of water by soil.

915. Richards, L. A. SAMPLE RETAINERS FOR MEASURING WATER RETENTION BY SOIL. Soil Sci. Soc. Amer. Proc. 20(3): 30.-303. May 1956. 56.9 So3

A report was given on the use of suction control surfaces, ceramic or celulosic, for measuring the relation of water content of soil to suction.

916. Richards, L. A. WATER RETENTION AND TRANSMISSION IN SOIL. Hawaiian Sugar Tech. Rpt. Annu. Mtg. 16: 43-46. Ref. 1957. 65.9 H317

A review of the literature and a discussion were given on water retention and transmission in the soil.

917. Richards, L. A. ADVANCES IN SOIL PHYSICS. Internatl. Soc. Soil Sci. Cong. Trans. 7(1): 67-79. Ref. 1960. 56.09 In847T

A review of the literature was given on some of the general aspects of the physics of soil water.

918. Richards, L. A., Bower, C. A., and Fireman, M. TESTS FOR SALINITY AND SODIUM STATUS OF SOIL AND OF IRRIGATION WATER. U.S. Dept. Agr. C. 982, 19 pp. 1956. 1 Ag84C

Tests were given for estimating the agricultural significance of soluble salt and exchangeable sodium in soil and the quality of irrigation water. The tests were intended primarily for professional agricultural workers and were designed to give a maximum of information for a minimum of effort.

919. Richards, L. A., and Decker, D. L. DIFFICULTIES WITH ELECTROLYTIC-RESISTANCE HYGROMETERS AT HIGH HUMIDITY. Soil Sci. Soc. Amer. Proc. 27(4): 481. 1963. 56.9 So3

Humidity measurements with a precision of about ±0.002 percent can be made in the range near saturation with thermocouple psychrometers, but the measurement conditions are exacting. Electrolytic-resistance type hygrometers have much easier operating requirements, but so far, commercial types have not been designed for plant and soil measurements where humidities above 99 percent are encountered. Under such conditions their response time is often unacceptably long and the calibration is strongly dependent on recent past use conditions. The tests reported illustrated the difficulties which apparently are typical for the resistance hygrometers now available.

920. Richards, L. A., and Ogata, G. MATERIALS FOR RETAINER PLATES AND THEIR USE FOR RETENTIVITY MEASUREMENTS. Soil Sci. Soc. Amer. Proc. 20(3): 303-306. Ref. May 1956.

A report was given on the selection of ceramic materials suitable for use as sample retainer plates.

921. Richards, L. A., and Ogata, G. VAPOR PRESSURE DEPRESSION AT A TENSIOMETER CUP. Internatl. Cong. Soil Sci. Trans. 7(I): 279-283. 1960. 56.09 In847T

A thermocouple psychrometer was used for determining the physical status of water at the air-water interface of a porous cup such as that used in soil moisture tensiometers. The usual gas-liquid phase arrangement for a tensiometer was reversed since the psychrometer was exposed to the air inside the porous cup when the outside of the cup was immersed in water or salt solution at controlled pressure less than atmospheric pressure. The relative pressure, p/p_0, of the water vapor in the air inside the porous -up could thus be controlled either by the pressure reduction across the porous wall (matric suction) or by the osmotic pressure of the solution in the porous wall, or both. The experimental results conformed to theory which requires that a unit of matric suction is equivalent to a unit of osmotic pressure in reducing relative vapor pressure.

922. Richards, L. A., and Richards, P. L. RADIAL-FLOW CELL FOR SOIL-WATER MEASUREMENTS. Soil Sci. Soc. Amer. Proc. 26(6): 515-518. Nov./Dec. 1962. 56.9 So3

A cylindrical ceramic cup, centrally placed in a cylindrical core sample of soil has several advantages over the conventional arrangement of a plane suction control surface at one end of a soil column. The solution of the radial-flow equation was given for the appropriate boundary conditions. The radial-flow cell is useful for measuring retentivity, specific capacity, diffusivity, and conductivity of water in a core sample of soil having quasi-undisturbed structure.

923. Richards, L. A., and Richards, S. J. SOIL MOISTURE. U.S. Dept. Agr. Ybk. Agr. 1957: 49-60. 1957. 1 Ag84Y

A discussion was given on the need and management, for the right moisture content of soils. Methods to measure soil moisture were discussed.

924. Richards, S. J. TIME TO IRRIGATE? What's New In Crops and Soils. 9(8): 9-11. June/July 1957. 6 W55

A report was given on soil moisture tensiometers and resistance blocks used for measuring soil moisture to determine the correct time to irrigate.

925. Richards, S. J., and Hagan, R. M. SOIL MOISTURE TENSIOMETER; HOW IT WORKS, HOW TO USE IT. Calif. U. Agr. Ext. L. 100, 8 pp. (folder) Feb. 1958. 275.29 C12Lea

A report was given on the description and use of soil moisture tensiometers in California.

926. Richards, S. J., and Weeks, L. V. MOISTURE MOVEMENT IN SOILS. Calif. Agr. 11(4): 24, 37. Apr. 1957. 100 C12Cag

A report was given on soil moisture movement and soil factors which influence that movement.

927. Richason, B. F. WETLAND TRANSFORMATION IN THE WISCONSIN DRIFT AREA OF INDIANA. Ind. Acad. Sci. Proc. 69: 290-299. maps. 1959, pub. 1960. 500 In2

A report was given on the need and use of drainage in the Wisconsin drift area in Indiana.

928. Rigg, G. B. PEAT RESOURCES OF WASHINGTON. Wash. Dept. Conserv. Div. Mines and Geol. B. 44, 272 pp. maps. 1958. 406 W27

The peat resources of Washington were described and classified. Profile maps of the various bogs were illustrated.

929. Rigot, G. UTILIZATION OF PEAT; BIBLIOGRAPHICAL STUDY. (Fr) B. Agr. du Congo. 52(6): 1305-1333. Ref. Dec. 1961. 24 K83

930. Ringoet, A. THE TECHNIQUE OF MEASURING POTENTIAL AND REAL EVAPOTRANSPIRATION IN CULTURES. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 99-104. Ref. 1959. 292.9 As7C
English summary.

A technical method was proposed which allows the measurement of potential and actual evapotranspiration of annual crops and herbaceous plant associations in normal ecological growth conditions by daily weighing of the pots, placed on low easily manageable wagons.

931. Ripado, M. F. B. PEAT SOILS OF SOUTHERN MOZAMBIQUE. Inter-African Soils Conf. Proc. 2: 927-932. 1954. 56.09 In846

A report was given on the chemical and physical properties of some peat soils of southern Mozambique in Africa. A discussion was given of the use of proper drainage and simple water control methods for these soils to grow rice, bananas, and vegetables.

932. Rivoira, G. QUICK DETERMINATION OF MOISTURE IN SOILS, INDISPENSABLE CONDITION IN IRRIGATION RESEARCH. (It) Prog. Agr. [Bologna] 8(1): 108-110. Ref. Jan. 1962. 58.8 P64

933. Robins, J. S. MOISTURE MOVEMENT AND PROFILE CHARACTERISTICS IN RELATION TO FIELD CAPACITY. Internatl. Comn. on Irrig. and Drain. 3(3): 8.509-8.521. 1957. 55.9 C7652

A report was given on the effect of soil profile characteristics on moisture movement at field capacity.

934. Robinson, A. R., and Rohwer, C. MEASUREMENT OF CANAL SEEPAGE. Amer. Soc. Civil Engin. Proc. Volume 81, Sep. No. 728. June 1955. 290.9 Am3Ps

A study was made to: (1) Preview the existing methods of measuring seepage; (2) develop new methods of measuring seepage; and (3) examine the factors that affect seepage.

Seepage rings were used because they were accurate in measuring seepage rates in small, isolated areas. The study showed that soil type was only one factor determining the seepage rate.

Calibration of seepage meters showed that although the meters did not provide an accurate method of measuring seepage, they did indicate the order of the loss.

935. Robinson, A. R., Jr., and Rohwer, C. MEASUREMENT OF CANAL SEEPAGE. Amer. Soc. Soil Sci. Trans. 122: 347-363. 1957. 290.9 Am3

Existing methods of measuring seepage were investigated in an effort to develop new methods and to study the factors affecting seepage. Special studies included the effect of depth of water on seepage, the effect of the depth to ground water, and the effect of temperature on the seepage rate. Seepage meters were found to indicate the order of magnitude of loss, although they did not provide accurate measurement. A method of analysis was developed for using the well-permeameter test results in forecasting seepage.

With discussion by Messrs. Raymond A. Hill; Dean C. Muckel; Calvin C. Warnick; N. Szalay; Cyril W. Lauritzen; and August R. Robinson, Jr., and Carl Rohwer. pp. 364-373.

936. Robinson, A. R., Jr., and Rohwer, C. MEASURING SEEPAGE FROM IRRIGATION CHANNELS. U.S. Dept. Agr. Tech. B. 1203, 82 pp. Ref. Sept. 1959. 1 Ag84Te

A detailed report was given on the measurement of seepage from irrigation channels for the design of a drainage system or the use of seepage control methods.

937. Robinson, F. E. RESULTS OBTAINED WITH LIGHT-WEIGHT RATE METER FOR NEUTRON SOIL-MOISTURE MEASUREMENTS. Soil Sci. 96(3): 218-219. Sept. 1963. 56.8 So3

The light-weight neutron moisture meter described by Van Bavel (1962) was used to measure soil moisture in percentage in Hawaiian soils with a precision of ±1 percent.

938. Robinson, F. E. USE OF NEUTRON METER TO ESTABLISH SOIL MOISTURE STORAGE AND SOIL MOISTURE WITHDRAWAL BY SUGARCANE ROOTS. Hawaii Sugar Tech. Rpt. Annu. Conf. 22: 206-208. 1963, pub. 1964. 65.9 H317

A report was given on the use of the neutron meter to establish soil moisture storage and soil moisture withdrawal by sugarcane crops in Hawaii.

939. Robinson, J. B. D. CULTIVATION OF VLEI SOILS. Kenya Coffee. 25(292): 127, 129, 131, 133. Apr. 1960. 68.29 C652

A report was given on the drainage and management of vlei soils in Kenya for coffee production.

940. Rode, A. A. THE DIFFERENT SOIL WATER REGIME TYPES. (Fr) Cong. Internatl. de la Sci. du Sol. Rap. 6(B, comn. I): 117-125. 1956. 56.09 In8452
English summary.

The soil water regime type is determined by climatic and relief conditions; water holding capacity of soils; drainage conditions; and vegetable cover. A classification of soil water regime types were given along with a brief description of each.

941. Rode, A. A. SOIL WATER TYPES AND FORMS AND HYDROLOGICAL PROPERTIES OF SOILS. (Fr) Cong. Internatl. de la Sci. du Sol. Rap. 6(B, comn. I): 135-147. 1956. 56.09 In8452
English summary.

The effect of texture and aggregate composition on the interaction between soil moisture and the solid part of the soil were discussed.

942. Rognerud, B. METHODS FOR DETERMINING MOISTURE IN SOIL AND ITS IMPORTANCE IN IRRIGATION. (No) Frukt og Baer. 13: 52-60. Ref. 1960. 80 F9428

943. Rose, C. W. SOME EFFECTS OF RAINFALL, RADIANT DRYING, AND SOIL FACTORS ON INFILTRATION UNDER RAINFALL INTO SOILS. J. Soil Sci. 13: 386-298. 1962. 55.8 J823

The effect of the structural condition of a soil on infiltration under laboratory-simulated rainfall was investigated. Infiltration was greater with better structural condition for both undisturbed and disturbed samples. The infiltration rate of a soil surface damaged by intense rainfall decreased as rainfall continued. After equal periods of exposure there was little difference, for any of three soils examined, between total infiltration of rainfall at a rate of 6 inches per hour and at 4 inches per hour. The application of a pressure less than atmospheric to the underside of 2-inch-deep samples, simulating the moisture tension observed in the transmission zone on infiltration into deep soil columns, did not increase infiltration under rainfall as would be expected. For a clay soil previously exposed to rainfall, infiltration rate after radiant drying for 24 hours and rewetting was only half that of replicates that were dried in shade.

944. Rosenqvist, I. T. PHYSICO-CHEMICAL PROPERTIES OF SOILS: SOIL-WATER SYSTEMS. J. Soil Mech. and Found. Div., ASCE 85(SM 2): 31-53. Apr. 1959. 290.9 Am3Ps

The heat of wetting, the diffusibility of hydrogen and isotopic prothiumdeutrium exchange, indicate that a part of the water in a clay-water system should be considered as belonging to the mineral phase. The minerals thus consist of a central silicate skeleton with an outer part of aqueous composition. The presence of this outer part is the essential characteristic of the mineral phase in a clay-water system. Typical clay properties, such as cohesion and plasticity, were discussed in terms of this concept. The Bowden friction theory was assumed to be valid in clay-water systems.

945. Rosenqvist, I. T. MECHANICAL PROPERTIES OF SOIL-WATER SYSTEMS. Amer. Soc. Civil Engin. Trans. 126(1): 745-746. Ref. 1961. 290.9 Am3

The heat of wetting, the diffusibility of hydrogen and isotopic prothium-deutrium exchange, indicated that a part of the water in a clay-water system should be considered as belonging to the mineral phase. The minerals thus consist of a central silicate skeleton with an outer part of aqueous composition. The presence of this outer part is the essential characteristic of the mineral phase in a clay-water system. Typical clay properties, such as cohesion and plasticity were described in terms of this concept. The Bowden friction theory was assumed to be valid in clay-water systems.

With discussion by Alan S. Michaels; and I. T. Rosenqvist. pp. 767-779.

946. Rozanov, A. N. IRRIGATED SOILS SALINIZATION AND THEIR IMPROVEMENT. (Fr) Cong. Internatl. de la Sci. du Sol. Rap. 6(D comn. VI): 669-674. 1956. 56.09 In8452
English summary.

A report was given on the salinization of irrigated soils in the U.S.S.R. and their improvement.

947. Rubin, J., and Steinhardt, R. SOIL WATER RELATIONS DURING RAIN INFILTRATION: I. THEORY. Soil Sci. Soc. Amer. Proc. 27: 246-251. 1963. 56.9 So3

Soil moisture content changes and rates of water entry during rain infiltration into a semi-infinite soil column were analyzed mathematically. The model considered involves, principally, the following assumptions: Darcy's and continuity equations are applicable; the soil's hydraulic conductivity and diffusivity are unique, positive, and monotonically increasing functions of soil moisture contents; rainfall entering the soil can be considered as a continuous body of water.

It was shown analytically that an incessant rain eventually results in ponding only if rain intensity, R, exceeds the saturated soil's hydraulic conductivity, $K(w_{sat})$. For $R \leqslant K(w_{sat})$ it was proven that as infiltration proceeds soil moisture contents at increasing depths tends to approach a constant level. At this level, the soil's hydraulic conductivity equals the rain intensity. For $R > K(w_{sat})$ it was indicated how to estimate the water uptake at incipient ponding.

948. Rubin, J., and Steinhardt, R. SOIL WATER RELATIONS DURING RAIN INFILTRATION. III. WATER UPTAKE AT INCIPIENT PONDING. Soil Sci. Soc. Amer. Proc. 28(5): 614-619. Ref. Sept./Oct. 1964. 56.9 So3

Rain-induced ponding onset was studied. It was analyzed theoretically, by using a diffusion-type equation of soil moisture flow and investigated experimentally, by employing laboratory columns of a sandy soil.

949. Rubin, J., Steinhardt, R., and Reiniger, P. SOIL WATER RELATIONS DURING RAIN INFILTRATION: II. MOISTURE CONTENT PROFILES DURING RAINS OF LOW INTENSITIES. Soil Sci. Soc. Amer. Proc. 28(1): 1-5. 1964. 56.9 So3

During transient-state infiltration of steady, low intensity rain into laboratory soil columns, moisture contents at increasing soil depths tended with time to approach a constant level. This level, as well as the observed rates of wetting-front advance, were higher in cases of more intense rain. Soil moisture contents and wetting-front advance rates associated with ponded-water infiltration were generally considerably higher than those of rain infiltration profiles.

The differences between the observed and the theoretically predicted rain infiltration profile data were insignificant for rains of low intensity but significant for those of higher intensity.

950. Rubstov, D. M. PODZOLIC-BOG SOILS. (Rus) Pochvovedenie. 7: 20-31. Ref. July 1960.
57.8 P34
English summary.
English translation—Soviet Soil Sci. 7: 705-714. July 1960. 57.8 P34Ae

A report was given on the formation of podzolic-bog soils in the U.S.S.R.

951. Ruellan, A. SOME PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SOILS ON THE ZEBRA PLAIN; THEIR EFFECTS ON THE POSSIBLE UTILIZATION. (Fr) France Off. Rech. Sci. Tech. Outre-Mer. Cahiers O.R.S.T.O.M. Pedol. 2(4): 49-62. Ref. 1964. 56.9 F84

952. Runge, E. C. A. INFLUENCE OF NATURAL DRAINAGE ON IRON AND PHOSPHORUS DISTRIBUTION IN SOME IOWA SOILS. Diss. Abs. 24(4): 1312-1313. Oct. 1963. 241.8 M58

An abstract was given on an experiment in Iowa to determine the effect that natural drainage class has on soil iron (Fe), phosphorous (P), and associated physical and chemical properties.

953. Russell, J. S., and Rhoades, H. F. WATER TABLE AS A FACTOR IN SOIL FORMATION. Soil Sci. 82(4): 319-328. Ref. Oct. 1956. 56.8 So3

A report was given on the effect of the water table on soil formation.

954. Russell, M. B., ed. WATER AND ITS RELATION TO SOILS AND CROPS. Adv. Agron. 11: 1-131. Ref. 1959. 30 Ad9

A review of the literature and a discussion were given by a group of authors on various phases of the subject of the relation of water to soil.

955. Rybtsov, D. M. PODZOLIC-BOG SOILS. Pochvovedenie. 7: 32-42. July 1960. 57.8 P34
English translation—Soviet Soil Sci. 7: 705-714. July 1960. 57.8 P34Ae

In a study of podzolic-bog soils in Russia the author made the following conclusions: (1) Peaty podzolic gley-like soils represent the initial bog stage of gleyed-podzolic soils of the northern taiga. Peat podzolic gleyed soils are the next bog stage. (2) The clay loam podzolic-bog soils described form under the influence of atmospheric wetting without the participation of ground water. (3) During the transition from peaty podzolic gley-like soils to peat podzolic gleyed soils the thickness of peat increases and the intensity and depth of gleyzation increase. With respect to chemistry, the humus content decreases, while its mobility increases. Mobile iron accumulates and exchangeable and hydrolytic acidities increase in the litter. (4) During the transition from peaty podzolic gley-like to peat podzolic gleyed soils, the podzolization process weakens even though the gleyzation process becomes more intense. And (5) from the zonal point of view, the process of podzolization in podzolic-bog soils tends to diminish from the southern sub-zone of the taiga to the northern and extreme north.

956. Sabol'ch, I. EFFECT OF DRAINAGE AND IRRIGATION ON SOIL FORMING PROCESSES IN THE HUNGARIAN LOWLAND. (Rus) Pochvovedenie. 10: 78-84. map. Ref. Oct. 1962. 57.8 P34
English translation—Soviet Soil Sci. 10: 1174-1178. Ref. Oct. 1962. 57.8 P34Ae

A report was given on the effect of drainage and irrigation on soil formation in lowlands of Hungary.

957. Saito, Y. INVESTIGATION ON THE PHYSICAL AND CHEMICAL PROPERTIES OF PADDY FIELD SOIL IN THE CENTRAL FARM. (Ja) Utsunomiya U. Col. Agr. B. 3(3): 265-267. Dec. 1957. 107.6 Ut7B

958. Sakaguchi, Y. ON THE PEAT LAYERS OF THE KIMOTSUKI ALLUVIAL PLAIN. (Ja) Res. Inst. Nat. Resources Misc. Rpt. 52/53: 93-95. maps. March 15, 1960. 513 T5722S
English summary.

A report was given on the genesis of peat areas in the Kimotsuki Alluvial Plain in Japan.

959. Sakhobiddinov, S. S. PEAT DEPOSITS OF UZBEKISTAN AND THEIR USE. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 140-146. 1957. 56.33 R922

960. Sandoval, F. M., Benz, L. C., and Mickelson, R. H. CHEMICAL AND PHYSICAL PROPERTIES OF SOILS IN A WET SALINE AREA IN EASTERN NORTH DAKOTA. Soil Sci. Soc. Amer. Proc. 28(2): 195-199. Mar./Apr. 1964. 56.9 So3

A large imperfectly drained saline soil area in the Red River Valley of North Dakota (glacial Lake Agassiz) was characterized chemically and physically.

The area studied was divided into the following principal physiographic areas: (1) The larger area comprised of deep lacustrine soils of low bulk density, frequently high Mg content, and soluble Na usually less than 50 percent of total soluble cations; and (2) a smaller area where dense glacial till was close to the surface and the soils had higher Na and B percentages. Soil and waters found along shallow drainways and sloughs draining the saline till area were laden with Na salts and probably toxic concentrations of B. The principal problem was excessive concentration of neutral water-soluble salts.

961. Sandoval, F. M., Jr., Frosberg, M. A., and Lewis, G. C. A CHARACTERIZATION OF THE SEBREE-CHILCOTT SOIL SERIES ASSOCIATION (SLICK SPOTS) IN IDAHO. Soil Sci. Soc. Amer. Proc. 23: 317-321. 1959. 56.9 So3

A study was made of the Sebree-Chilcott soil series association of southwestern Idaho with respect to morphology, physiography, and physical and chemical properties.

Parent materials are of fluviatile and lacustrine origin occurring on terraces of different geologic age. The Sebree soil (slick spots) is relatively impermeable with little or no vegetation. Diameter of the spots vary from a few inches to 50 feet or more, with irregular shapes.

The soils studied exhibit solodized characteristics with textural and color B horizons of solonetz morphology overlying prominent $CaCO_3$ accumulations. Degree of cementation of the calcareous layers appears to be related to geologic age. The surface has a silt loam texture.

Slick spot soils have a very thin A_2 horizon overlying thicker B_2 layers characterized by high exchangeable Na and in most cases high concentration of soluble salts. Ions that predominate are Na^+, SO_4^{--}, and Cl^-. Gypsum is present in the lower B_2 and B_3 horizons. Horizons of prominent lime accumulation have a bowl-shaped form under the slick spot.

962. Sarasto, J. A STUDY ON THE PERMEABILITY TO WATER OF DIFFERENT KINDS OF PEAT. (Fi) Suo. 14(3): 32-36. Ref. Nov. 5, 1963. 54.8 Su7
English summary.

A summary was given on the permeability to water of different kinds of peat in Finland.

963. Sartz, R. S. WATER YIELD AND SOIL LOSS FORM SOIL-BLOCK LYSIMETERS PLANTED TO SMALL TREES AND OTHER CROPS. U.S. Forest Serv. Res. Paper LS-6, 23 pp. 1963. A99.9 F7624U

From 1934-42 the Lake States Forest Experiment Station operated 10 large lysimeters at the Upper Mississippi Valley Soil Conservation Experiment Station, La Crosse, Wis. The lysimeters were 20 feet long, 10 feet wide, and 4 feet deep. They were filled with undisturbed blocks of Fayette silt loam plus an 8-inch layer of topsoil.

After a test period of about a year, treatments were established, and surface runoff, percolation, and soil loss were measured for 6 years. The treatments in six lysimeters were: Hardwood seedlings with leaf mulch (two lysimeters); hardwood seedlings without leaf mulch; Scotch pine seedlings with needle mulch; grass; and annual grain.

964. Sartz, R. S., and Curtis, W. R. FIELD CALIBRATION OF A NEUTRON-SCATTERING SOIL MOISTURE METER. U.S. Forest Serv., Lake States Forest Expt. Sta., Sta. Paper 91, 15 pp. Sept. 1961. 1.9622 L2St2

The field calibration of a neutron-scattering moisture meter was compared with the calibration curve furnished by the manufacturer. A method of adjusting shallow readings was described.

965. Saveson, I. L., Lund, Z. F., and Sloane, L. W. DEEP-TILLAGE INVESTIGATIONS ON COMPACTED SOIL IN THE COTTON AREA OF LOUISIANA. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-41; 21 pp. 1961. A56.9 R31

The deep-tillage investigations on Commerce silt loam soil containing restricting layers ("hot spots") indicate that deep tillage is effective in years of moisture stress. The soil moisture data indicated that the compacted areas interfered with the recharge of deep soil moisture during the winter. The edged and lifted 1 level treatments dispersed the compaction and facilitated (statistically significant) the deep soil moisture recharge by increasing infiltration of rainwater in the winter months. In this capacity the mixed treatment was not effective.

966. Sayegh, A. H., Alban, L. A., and Petersen, R. G. A SAMPLING STUDY IN A SALINE AND ALKALI AREA. Soil Sci. Soc. Amer. Proc. 22: 252-254. 1958. 56.9 So3

A study was made in the Baker Valley Area, Oregon, to determine by statistical analysis the variation in conductivity and exchangeagle-sodium percentage (ESP) between soil mapping units and between locations within soil mapping units.

The variation between soil mapping units was significant at the 1 percent level for both conductivity and ESP. The sample variation within locations and the location variation within soil mapping units were not large for soil conductivity but were quite large for ESP, particularly the individual sample variation. This indicates that for ESP the difference in the subsamples taken at one sampling location which make up a composite sample may vary as much or more than the samples taken over an area to represent a particular soil mapping unit.

967. Schafer, G. M., and Holowaychuk, N. CHARACTERISTICS OF MEDIUM- AND FINE-TEXTURED HUMIC-GLEY SOILS OF OHIO. Soil Sci. Soc. Amer. Proc. 22(3): 262-267. Ref. May/June 1958. 56.9 So3

Profile descriptions and chemical data were given for medium textured Humic-Gley Soils (poorly to very poorly drained) in Ohio.

968. Scheidegger, A. E. STATISTICAL HYDRODYNAMICS IN POROUS MEDIA. In Chow, V. T., ed. ADVANCES IN HYDROSCIENCE 1. Academic Press, N.Y. pp. 161-181. Ref. 1964. 292.8 Ad9

A detailed report was given on the flow of fluids through porous media.

969. Schiff, L. DEVICES FOR MEASURING SOIL WATER MOVEMENT IN DESIGNING RECHARGE FACILITIES. Trans. ASAE 7(1): 67-69. 1964. 290.9 Am32T

A report was given on some devices used to measure soil water movement in designing recharge facilities.

970. Schleifer, H. LYSIMETER TESTS IN AUSTRALIA. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 54-74. Ref. 1959. 292.9 As7C

Water cycle values (precipitation, percolation, and evapotranspiration) obtained in "filled in" and "monolith" type lysimeters at Petzenkirchen, Austria were given.

971. Schmidt-Ries, H. STUDIES OF THE EXISTING HIGH MOORS OF THE GERMAN EIFEL REGION. I. (Ge) Gewasser u. Abwasser. 6: 40-80. Ref. 1954/55. 409.6 G33

972. Schoonover, W. R., Elgabaly, M. M., and Hassan, M. N. A STUDY OF SOME EGYPTIAN SALINE AND ALKALI SOILS. Hilgardia. 26(13): 565-596. Ref. May 1957. 100 C12H

Survey and field observations were made on some Egyptian saline and alkali soils. Their reclamation was discussed for drainage plus leaching. Some of the areas need a soil amendment such as gypsum.

973. Schultz, J. D. FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METER. U.S. Forest Serv. Res. Note INT-21, 7 pp. 1964. A99.9 F764Un

Two neutron-scattering soil moisture meters of different design were compared under identical conditions and correlation curves were presented for the use of either one or both for field use.

974. Schumm, S. A., and Lusby, G. C. SEASONAL VARIATION OF INFILTRATION CAPACITY AND RUNOFF ON HILLSLOPES IN WESTERN COLORADO. J. Geophysical Res. 68: 3655-3666. 1963. 470 J823

Hillslope erosion was studied during 4 years along 25 slope profiles on Mancos shale hillslopes in western Colorado. Erosion was measured by the movement of markers and exposure of stakes. During winter, the soil surface was loosened by frost action, and the stakes showed minimum exposure in the spring. Rain-beat during the spring and summer compacted the soil, and the stakes showed maximum exposure during the fall. Frost action and compaction caused creep to occur in the upper 2 inches of the lithosols. During spring and summer, compaction of the soil by rain-beat decreased infiltration capacity, and runoff increased. Rills formed on the slopes, but these were soon destroyed by winter front action and creep, and the infiltration capacity of the soil was increased.

975. Schwab, G. O. SUMMARY. Agr. Engin. 40(5): 280. May 1959. 58.8 Ag83

The papers given at the symposium on experiences in measuring hydraulic conductivity for drainage design at the winter meeting of the American Society of Agricultural Engineers were summarized in this report.

976. Seginer, I., and Levine, G. INFILTRATION OF WATER UNDER PRESSURE FROM A PIEZOMETER CAVITY INTO A HOMOGENEOUS SOIL. I. ONE-DIMENSIONAL INFILTRATION. Soil Sci. 97(1): 48-57. Jan. 1964. 56.8 So3

Results of experiments were given on testing the hypothesis that the rate of advance of a steep wetting front could be used to determine the hydraulic conductivity, at saturation, of soils, and to evaluate the effect of trapped air upon the determination.

977. Semenov, E. I. CONDITIONS OF FORMATION AND UTILIZATION TRENDS OF PEAT SUPPLIES IN CENTRAL AREAS. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 158-182. Ref. 1957. 56.33 R922

978. Shah, R. K., Trivedi, A. M., and Vora, J. C. SALINE AND ALKALI SOILS OF THE LITTLE RUNN OF KUTCH. J. Soil and Water Conserv. India. 8(4): 57-66. Ref. Oct. 1960. 56.8 J824

A report was given on the saline and alkali soils in the Little Runn area of India. The important factors contributing to the salinity of the area were given along with some suggestions for reclamation such as proper irrigation, proper drainage, and a system of dikes along the sea coast.

979. Sharma, R. G. TRIAL OF MEMBRANE BLOCK ELECTRICAL RESISTANCE UNIT FOR CONTINUOUS MEASUREMENT OF SOIL MOISTURE. Madras Agr. J. 48(9): 337-340. Sept. 1961. 22 M262

Results were given on a trial of membrane block electrical resistance units for continuous measurement of soil moisture in India.

980. Shaw, R. H., Runkles, J. R., and Barger, G. L. SEASONAL CHANGES IN SOIL MOISTURE AS RELATED TO RAINFALL, SOIL TYPE AND CROP GROWTH. Iowa Agr. Expt. Sta. Res. B. 457, pp. 223-239. Feb. 1958. 100 Io9

A report was given on seasonal changes in soil moisture in Iowa as related to rainfall, soil type, and crop growth.

981. Shaw, W. B. RESISTIVITY AND PHOTOGRAPHIC TECHNIQUES FOR SEEPAGE EVALUATION. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-90, pp. 56-67. Jan. 1965. A56.9 R31

A report and discussion was given on the use of resistivity and photographic techniques for a seepage evaluation study in California.

982. Shea, P. F. A POCKET-SIZED SALINITY METER FOR DETERMINATION OF WATER QUALITY. Internatl. Comn. Irrig. and Drain. Annu. B. 1963: 95-96. 1963. 55.9 In8A

A salinity meter for determining the dissolved solids content of irrigation and drainage water by measurement of electrical conductivity was described and illustrated. The meter is ideal for field use as it has no delicate moving parts, and it is very compact.

983. Shiga, Y., and Aomine, S. THE SOIL-FABRIC OF THE PLOWED LAYER OF THE PADDY RICE SOILS IN JAPAN. (Ja) J. Sci. Soil and Manure. 29(9): 406-410. Ref. Dec. 1958. 56.8 J27

984. Shimose, N., and Yoneda, S. A STUDY ON POLDER SOILS IN JAPAN. IX. FORMS AND DISTRIBUTION OF MANGANESE IN THE HORIZONS OF SOME HALOGENETIC POLDER SOILS IN RELATION TO PROFILE DEVELOPMENT. (Ja) J. Sci. Soil and Manure. 26: 349-354. Ref. Jan. 1956. 56.8 J27 English summary.

A report was given on the forms and distribution of manganese in the horizons of some halogenetic polder soils in Japan.

985. Shin, Y. H., and Oh, W. K. STUDIES ON CERTAIN CHARACTERISTICS OF HIGH AND LOW PRODUCTIVE PADDY SOILS. (Ko) Korea Inst. Agr. Res. Rpt. 3, pp. 1-16. Dec. 1960. 22.5 K843 English summary.

The morphology of 48 paddy soils was studied to determine the classification of paddy soils in Korea.

986. Shishkov, K. N. HOW TO ORGANIZE THE MEASUREMENT OF WATER IN THE SOIL. (Rus) Zemledelie. 1961(9): 76-78. Sept. 1961. 20 Z44

987. Shishkov, K. N. SOIL MOISTURE METER (TENSIOMETER) AND ITS USE IN THE STUDY OF THE BEHAVIOR OF SOIL MOISTURE. (Rus) Pochvovedenie. 8: 100-105. Ref. Aug. 1962. 57.8 P34
English translation—Soviet Soil Sci. 8: 863-868. Ref. Aug. 1962. 57.8 P34Ae

A report was given on the use of a tensiometer in the U.S.S.R. to study the behavior of soil moisture.

988. Shull, H. MANOMETER FOR MEASURING WATER-SURFACE LEVELS IN IRRIGATED FIELDS. Agr. Engin. 42(11): 622-623. Nov. 1961. 58.8 Ag83

Advantages of a manometer for measuring water-surface elevations in irrigated fields include: Simplicity and flexibility; the ability to measure relative water-surface levels from widely separated or inaccessible locations from one position; and reasonable accuracy. Disadvantages include possible errors due to air bubbles in the tubing lines leading to the field and the requirement of constant attendance to obtain readings.

989. Shull, H. INFLUENCE OF INSTALLATION DEPTH ON INFILTRATION FROM UNBUFFERED CYLINDER INFILTROMETERS. Soil Sci. 97(4): 279-280. Apr. 1964. 56.8 So3

A report was given on the influence of installation depth on infiltration from unbuffered cylinder infiltrometers.

990. Silva, A. A. Da. SOIL WATER AVAILABLE TO PLANTS. (Por) Agros [Lisboa] 41(2): 153-165. Mar./Apr. 1958. 15.5 Ag82

991. Simonson, G. H., Prill, R. C., and Riecken, F. F. FREE IRON DISTRIBUTION IN SOME POORLY DRAINED PRAIRIE SOILS IN IOWA. Iowa Acad. Sci. Proc. 64: 385-392. Ref. 1957. 500 Io93

The Wisenboden (poorly drained prairie soils) studied were lower in iron than the well drained soils. Free iron in Wisenboden soils was uniformly low in the A_1 horizons.
The poorly drained soils did not show an association of clay and free iron in the profile that was evident in the well drained Brunizem and Gray Podzol soils.

992. Sinclair, J. D., and Patric, J. H. THE SAN DIMAS DISTURBED SOIL LYSIMETERS. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 116-125. 1959. 292.9 As7C

A report was given on the problems of establishing and operating the lysimeters at the San Dimas Experimental Forest in California along with some preliminary results of their use.

993. Skiliarov, G. A. THE GENETIC AND PRODUCTIVE CHARACTER OF LOWLAND PEAT BOGS OF THE BEIBEZHI BLOCK. (Rus) In Riga Latviiskii nauchno-issledovatel'skii institut gidrotekhniki i melioratsil. VOPROSY OSVOENIIA OSUSHENNYKH TORFIANOBOLTNYKH POCHV LATVIISKOI SSR. Riga, Akademiia Nauk Latviiskoi SSR, pp. 3-118. Ref. 1957. 56.26 R44

994. Skrynnikova, I. N. AGAIN ON CLASSIFICATION PRINCIPLES OF PEAT-BOG SOILS. (Rus) Pochvovedenie. 9: 45-48. Ref. Sept. 1955. 57.8 P34

995. Skrynnikova, I. N. CLASSIFICATION OF VIRGIN BOG AND RECLAIMED PEAT SOILS OF THE USSR. (Rus) Pochvovedenie. 5: 14-26. Ref. May 1964. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 5: 455-456. Ref. May 1964. 57.8 P34Ae

A report was given of the need and classification of virgin bogs and reclaimed peat soils in the U.S.S.R.

996. Skurtul, A. ASPECTS OF SECONDARY SALINIZATION OF SOILS ON THE KARAGASH IRRIGATION SYSTEM. (Rus) Zeml. i Zhivotn. Moldavii. 9: 24-25. Sept. 1962. 20 Z45

997. Slavnyi, Y. A., and Hsavrygin, P. I. CONDITIONS LEADING TO THE GLEIZATION OF SOILS IN THE AMUR-ZEYA INTERFLUVE. (Rus) Pochvovedenie. 4: 98-107. Ref. Apr. 1964. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 4: 418-425. Ref. Apr. 1964. 57.8 P34Ae

A report was given on the origin of gleying in soils in the Amur-Zeya area of the U.S.S.R. The use was stressed of drainage to improve the aeration of these soils and their productivity.

998. Smerdon, E. T., Hohn, C. M., Newman, J. S., and Thaxton, E. 1., Jr. WATER DISTRIBUTION ALONG SURFACE IRRIGATION RUNS. Tex. Agr. Expt. Sta. Prog. Rpt. 2275, 4 pp. 1963. 100 T31P

In Texas, infiltration rates, which occurred during furrow irrigation, were determined for Regan silt clay loam soil at Pecos, Miller silt clay loam soil at College Station, and Amarillo loam soil at Lubbock. Uniformity of water distribution was determined for the three locations and compared. The soil at Pecos gave the most uniform distribution though the irrigation runs were the longest. The cracked soil at College Station gave the lest uniform distribution of water in spite of very short runs.

999. Smet, L. A. H. De. PEDOLOGICAL RECONNAISSANCE MAP OF THE PEAT RECLAMATION DISTRICTS IN SOUTHERN GRONINGEN, DRENTE AND NORTHERN OVERIJSSEL. (Du) Boor en Spade. 10: 143-156. Ref. 1959. 56.9 B64
English summary.

Pedological reconnaissance maps were given of some peat land.

1000. Smiles, D. E., and Youngs, E. G. A MULTIPLE-WELL METHOD FOR DETERMINING THE HYDRAULIC CONDUCTIVITY OF A SATURATED SOIL IN SITU. J. Hydrol. 1(4): 279-287. 1963. 292.8 J82

Potential theory was used to obtain a general relationship to describe the flow of water in a radially symmetrical array of wells which penetrate beneath the water table and in which alternate wells act as sources and sinks. Experimental verification of the use of this relationship in the measurement of the hydraulic conductivity of a uniform isotropic porous material was presented.

1001. Smith, R., and Robertson, V. C. A CLASSIFICATION OF THE SALINE SOILS OF THE OLD IRRIGATED LANDS OF THE MIDDLE TIGRIS VALLEY. Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comn. VI): 693-698. 1956. 56.09 In8452

A report was given of soil and land classification surveys of soils in Irak. Only well drained, coarser textured soils were non-solonized and non-saline.

1002. Smith, S. T. SOIL SALINITY IN WESTERN AUSTRALIA. West. Austral. Dept. Agr. J. (ser. 4) 2(9): 757-760. Sept. 1961. 23 W52J

A background of Western Australias' soil salinity problems and a description of the main types of salt affected lands were given. Ways to live with these areas and to prevent salt encoachment by crop and land management were discussed.

1003. Smits, H. SOIL IMPROVEMENT RESEARCH IN THE I JSSELMEER POLDERS. (Du) Van Zee tot Land. 36: 56-68. 1963. 54.8 V26
English summary.

A report was given on the soil improvement research on the I Jseelmeer polders in the Netherlands. Soil surveys were made shortly before and after emerging, and then repeated mappings were made after the processes of reclamation. Most of the soils have profiles with sandy layers above, under, or between heavier soil layers.

1004. Smits, H., and Wiggers, A. J. SOIL SURVEY AND LAND CLASSIFICATION AS APPLIED TO RECLAMATION OF SEA BOTTOM LAND IN THE NETHERLANDS. Internatl. Inst. Land Reclam. and Impr. P. 4, 60 pp. maps. Ref. 1959. 54.9 In8

The necessity of detailed soil investigation, land classification, and intensive planning as a means to the best agricultural, economic, and social land use in the Netherlands was given for land that was once sea bottom.

Soils were classified according to: It's permeability; the desirable spacing of tile drains; and needs and desirability of subirrigation. Some soil types were improved by deep plowing or by mixing of the layers.

1005. Snegirev, I. A. NEW METHOD OF CALCULATION OF UNDERGROUND WATER MOVEMENT. (Rus) Gidrotekh. i Melior. 11: 31-34. Nov. 1962. 290.8 G362

1006. Snell, A. W., and van Schilfgaarde, J. FOUR-WELL METHOD OF MEASURING HYDRAULIC CONDUCTIVITY IN SATURATED SOILS. Trans. ASAE 7(1): 83-87, 91. Ref. 1964. 290.9 Am32T

A discussion was given on the four-well method of measuring hydraulic conductivity in saturated soils. Water is pumped from one of the outer wells to the other and the potential drop is measured between the two inter wells.

1007. Soane, B. D. CONSTRUCTION AND USE OF A CHEAP TENSIOMETER FOR RESEARCH WORKERS. Rhodesia Agr. J. 57(3): 244-250. Ref. May/June 1960. 24 R34

A cheap tensiometer was described. The testing and use of the instrument were described and the field use of the tensiometer in Rhodesia was discussed.

1008. Soane, B. D., and Calissendorff, C. THE RAPID DETERMINATION OF SOIL WATER CONTENT USING THE CARBIDE METHOD. Rhodesia Agr. J. 57(5): 386-392. Sept./Oct. 1960. 24 R34

A report was given of the use of the carbide method of soil moisture measurement in Rhodesia.

1009. Sonneveld, F. APPLICATIONS OF SOIL SURVEY IN THE NETHERLANDS. IV. SOIL IMPROVEMENT AND DRAINAGE. Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comn. VI): 645-651. 1956. 56.09 In8452

A report was given on the use of soil surveys in the Netherlands for soil improvement (land leveling and mixing of soil layers) and drainage.

1010. Sor, K., and Bertrand, A. R. EFFECTS OF RAINFALL ENERGY ON THE PERMEABILITY OF SOILS. Soil Sci. Soc. Amer. Proc. 26: 293-297. 1962. 56.9 So3

The effects of simulated rainfall on the air and water permeabilities of sand and several disturbed soil samples were investigated. Various rainfall intensities were provided by a rainfall simulator. Soil was packed in a cylindrical infiltrometer, to which was connected eight manometers. Permeability of the soil to water was measured during and after the application of rainfall.

A rainfall of 30 minutes duration at an intensity of 2.8 inches per hour caused maximum change in water permeability of the soils. Water permeability of quartz sand was not changed by rainfall. Water permeability of soils was changed: (1) Only in top 1.5 cm. by 1.6 inches per hour rainfall; and (2) greatly in top 1.5 cm. and somewhat less in second 1.5 cm. layer by 2.8 and 4.0 inches per hour rainfall. In saturated soil columns, water permeability was not governed entirely by the permeability of the least permeable layer. The thickness of the dispersed and compacted soil layer appeared to be about 1 mm. Below it a less compacted layer, about 3 cm. deep, resulted.

1011. Speir, W. H. INSTALLATION AND OPERATION OF NON-WEIGHING LYSIMETERS. Soil and Crop Sci. Soc. Fla. Proc. Annu. Mtg. 22: 167-176. 1962, pub. 1963. 56.9 So32

A report was given on the installation and operation of non-weighing lysimeters in Florida by the Central and Southeastern Florida Flood Control District.

1012. Stakhnevich, V. L., and Zadunaiskii, I. N. WORK OF THE INSTITUTE "GIPROTORFRAZVEDKA" ON PEAT SUPPLY SURVEYS AND PLANNING OF PEAT UNDERTAKINGS. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 5-14. 1957. 56.33 R922

1013. Stepanov, L. N. THE USE OF POLYMERS IN THE DRAINAGE OF MINERAL OVERMOISTENED SOILS. (Rus) Gidrotekh. i Melior. 1960(1): 24-26. Jan. 1960. 290.8 G362

1014. Stewart, E. H., Powell, D. P., and Hammond, L. C. MOISTURE CHARACTERISTICS OF SOME REPRESENTATIVE SOILS OF FLORIDA. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-63, 53 pp. map. Apr. 1963. A56.9 R31

Physical and chemical moisture retention properties of Florida soils were given as an aid in planning effective soil water management.

1015. Stewart, G. L. R. WATER CONTENT MEASUREMENT BY NEUTRON ATTENUATION AND APPLICATIONS TO UNSATURATED FLOW OF WATER IN SOIL. Diss. Abs. 23(12, pt. 1): 4487. June 1963. 241.8 M58

An abstract was given on an experiment using neutron attenuation to measure the unsaturated flow of water in soil in Washington.

1016. Stewart, G. S., and Taylor, S. A. FIELD EXPERIENCE WITH THE NEUTRON-SCATTERING METHOD OF MEASURING SOIL MOISTURE. Soil Sci. 83(2): 151-158. Feb. 1957. 56.8 So3

Field experience was reported for the use of a portable neutron-scattering method of soil moisture measurement.

1017. Stokstad, O. SOIL SURVEY INTERPRETATIONS FOR ENGINEERING PURPOSES. Soil Sci. Soc. Amer. Proc. 22(2): 164-166. 1958. 56.9 So3

The background for the common interests shared by pedologists and engineers was reported. Some engineering attitudes toward soils were discussed and a soil scientist's approach to soil engineering problems was suggested. The paper further describes the nature of a productive cooperation between pedologist and engineer and discusses the obligations of each in order that their efforts may best serve engineering needs.

1018. Stolzy, L. H., and Cahoon, G. A. A FIELD CALIBRATED PORTABLE NEUTRON RATE METER FOR MEASURING SOIL MOISTURE IN CITRUS ORCHARDS. Soil Sci. Soc. Amer. Proc. 21(6): 571-575. Ref. Nov./Dec. 1957. 56.9 So3

A portable neutron rate meter for measuring soil moisture in citrus orchards was described and illustrated. The equipment and method of calibration have given very satisfactory results in the field.

1019. Stolzy, L. H., Cahoon, G. A., and Szuszkiewicz, T. E. MEASUREMENT OF SOIL MOISTURE. Calif. Agr. 11(4): 21-22, 37. Apr. 1957. 100 C12Cag

Accurate instruments were described for measuring soil moisture conditions.

1020. Stolzy, L. H., Crabb, G. A., and Erickson, A. E. THE USE OF A RECORDING RESISTANCE BRIDGE IN SOIL MOISTURE STUDIES. Mich. Agr. Expt. Sta. Q. B. 41(4): 768-777. May 1959. 100 M58S

A report was given on the use of Bouyoucos plaster of paris blocks, Leeds and Northrup Micromax, and recording Wheatstone bridge for soil moisture measurement in Michigan.

1021. Stolzy, L. H., Marsh, A. W., Puffer, R. E., and Baier, D. C. PLACEMENT OF TENSIOMETERS. Calif. Citrog. 45(2): 39, 48, 50-51. Dec. 1959. 80 C125

A discussion was given on the correct placement of tensiometers for soil moisture measurement in citrus orchards in California.

1022. Stone, J. F., Kirkham, D., and Read, A. A. SOIL MOISTURE DETERMINATION BY A PORTABLE NEUTRON SCATTERING MOISTURE METER. Soil Sci. Soc. Amer. Proc. 19: 419-423. Ref. Oct. 1955. 56.9 So3

A portable, battery-powered device for the measurement of soil moisture by neutron scattering was described and illustrated. Field data were presented. When the source-detector was located at various depths in a pipe sunk vertically into the soil, except for the surface 6 to 9 inches, the equipment generally gave the soil moisture per unit soil bulk volume, within the range of the standard deviation of gravimetric determinations.

1023. Strijbosch, T. USE OF TENSIOMETERS. (Du) Groenten en Fruit. 13(4): 127-128. July 25, 1957. 80 G89

1024. Struchtemeyer, R. A. MEASURE YOUR SOIL MOISTURE. Maine Farm Res. 6(1): 37-38. Apr. 1958. 100 M28Ma

A report was given on the use of the gypsum moisture block and the Bouyoucos meter to obtain soil moisture measurement in Maine.

1025. Sudo, S., Yasutomi, R., and Suzuki, T. STUDIES ON THE PHYSICAL PROPERTIES OF PADDY FIELD IN NISHIME BEACH DUNES. (Ja) Yamagata Agr. and Forestry Soc. J. 14: 21-25. map. Ref. Oct. 1959. 22.5 Y14

1026. Sutton, J. G. THE NETHERLANDS EQUIPMENT FOR MAKING AUGER HOLE MEASUREMENTS. J. Soil and Water Conserv. 13(4): 173. July 1958. 56.8 J822

A kit demonstrated by J. M. van Staveren for measuring soil permeability below the water table, developed by W. C. Visser of the Netherlands was described and illustrated. A open-type 4-inch diameter post hole auger is used to bore a hole to the proposed drain depth or at least 15 to 18 inches below the water table.

1027. Suzuki, S. PRODUCTION AND USE OF TENISOMETERS. (Ja) Nogyodoboku-Kenkyu. 30(8): 435-439. Apr. 1963. 290.8 N68

1028. Svinarev, V. I., and Burtseva, E. S. SECONDARY SALINIZATION OF KYZEL-KUM DESERT SOILS UNDER IRRIGATION WITH ARTESIAN WATERS AND METHODS OF ELIMINATING IT. (Rus) Pochvovedenie. 1: 28-31. Jan. 1964. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 1: 19-21. Jan. 1964. 57.8 P34Ae

A report was given on the secondary salinization of desert soils of Kyzel-Kum by the use of saline artesian water methods. It was recommended that salt tolerant trees and crops be used along with a change to sprinkler irrigation systems.

1029. Swartzendruber, D., and Kirkham, D. CAPILLARY FRINGE AND FLOW OF WATER IN SOIL. Soil Sci. 81: 473-484. Ref. June-July 1956. 56.8 So3

A two-dimensional flow problem was presented and solved. The problem was conceived primarily as one which would lend itself well to the experimental study of essentially horizontal (saturated) flow in a capillary fringe.

1030. Swartzendruber, D., and Kirkham, D. CAPILLARY FRINGE AND FLOW OF WATER IN SOIL. II. EXPERIMENTAL RESULTS. Soil Sci. 82: 81-95. Ref. July 1956. 56.8 So3

A flow model for testing the solution was described and the experimental results with the models were compared with theory.

1031. Swartzendruber, D., and Olson, T. C. SAND-MODEL STUDY OF BUFFER EFFECTS IN THE DOUBLE-RING INFILTROMETER. Soil Sci. Soc. Amer. Proc. 25(1): 5-8. Ref. Jan./Feb. 1961. 56.9 So3

A report was given on a sand model study of the buffer effects in the double-ring infiltrometer. At any given time after infiltration had commenced, the velocity was essentially constant over a rather large central portion of the flooded area, but increased sharply as the outer ring radius (r_n) was closely approached.

1032. Swartzendruber, D., and Olson, T. C. MODEL STUDY OF THE DOUBLE-RING INFILTROMETER AS AFFECTED BY DEPTH OF WETTING AND PARTICLE SIZE. Soil Sci. 92(4): 219-225. Oct. 1961. 56.8 So3

Model studies of the double-ring infiltrometer were extended to include the effects of finer texture and the depth of the wet front. Both factors have a tendency to cause the infiltration velocity measured by the inner ring to overestimate the one-dimensional velocity, or infiltration rate. The infiltrometer with an inner ring of 40-inch diameter within an outer ring of 48-inch diameter was found adequate for all conditions considered.

1033. Szabolcs, I. HUNGARIAN ALKALI SOILS. (Fr) Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comm. VI): 603-608. 1956. 56.09 In8452
English summary.

A report was given on the types of alkali soils on the Hungarian Great Plains.

1034. Szabolcs, I. ALKALI SOILS IN LATIN AMERICA. (Hu) Agrokem. es Talajtan. 13(1/2): 157-164. July 1964. 385 Ag83

1035. Szilvassy, Z. RADIOACTIVE METHOD FOR SOIL DENSITY MEASUREMENT. (Hu) Vizugyi Kozlem. 2: 223-227. 1963. 290.9 H89
English summary, pp. 37.

A report was given of the radioactive method used in Hungary for the measurement of soil density.

1036. Szkolnicka-Roszyk, S. CHEMICAL AND AGRONOMIC CHARACTERISTICS OF PEAT BOGS IN BIEBRZA AND NAREW RIVER BASIN. (Pol) Wroclaw. Wyzsza Szkola Roln. Zeszyty Nauk. Roln. 15: 49-62. Ref. 1962. 20.5 B75
English summary.

Chemical and physical characteristics were given for some peat bogs in Biebrza and Narew river basins in Poland.

1037. Szkolnicka-Roszyk, S. CHEMICAL AND AGRICULTURAL CHARACTERISTICS OF PEAT BOGS IN TYSMIENICA RIVER BASIN. (Pol) Wroclaw. Wyzsza Szkola Roln. Zeszyty Nauk. Roln. 16: 19-27. 1963. 20.5 B75
English summary.

Chemical and physical characteristics were given for some peat bogs in the Tysmienica river basin in Poland.

1038. Takagi, M., Matsusita, K., and Ono, S. SOIL CLASSIFICATION, PHYSICAL AND CHEMICAL PROPERTIES, AND FIELD EXPERIMENTAL DATA OF PADDY FIELDS ON SLOPE AND VALLEY LANDS. (Ja) Kyushu Agr. Res. 20: 132-135. Mar. 1958. 107.6 K996

1039. Takagi, M., and Ono, S. SOIL TYPES OF PADDY FIELDS IN NAGASAKI PREFECTURE. III. (Ja) Kyushu Agr. Res. 24: 227-228. June 1962. 107.6 K996

1040. Takai, Y., Koyama, T., and Kamura, T. MICROBIOLOGICAL STUDIES ON THE REDUCTION PROCESS OF PADDY SOILS. Cong. Internatl. de la Sci. du Sol. Rap. 6(C, colloque du Riz): 527-531. 1956. 56.09 In8452

A discussion was given of microbiological studies in Japan on the reduction process of paddy soils.

1041. Takenaka, H. RELATIONSHIP BETWEEN SOIL MOISTURE TENSION AND WATER CONTENT IN THE FIELD. (Ja) J. Sci. Soil Manure. 35(7): 260-264. July 1964. 56.8 J27
English abstract—Soil Sci. Plant Nutr. 11(1): 42-43. Jan. 1965. 56.8 So38

The relationship was given between soil moisture tension and water content on a sand dune soil and a loamy field in Japan.

1042. Takijima, Y., and Shiojima, M. STUDIES ON SOILS OF PEATY PADDY FIELDS. II. PHYSICAL AND CHEMICAL PROPERTIES OF SOILS AND THEIR CLASSIFICATION. (Ja) J. Sci. Soil and Manure. 29(7): 301-306. Ref. Oct. 1958. 56.8 J27

1043. Takijima, Y., and Shiojima, M. STUDIES ON SOILS OF PEATY PADDY FIELDS. II. PHYSICAL AND CHEMICAL PROPERTIES OF SOILS AND THEIR CLASSIFICATION. (Abs.) Soil and Plant Food. 4(3): 153. Dec. 1958. 56.8 So38

Physical and chemical properties of peat soils and their classification in Japan were given.

1044. Takijima, Y., Shiojima, M., and Konno, K. STUDIES ON SOILS OF PEATY PADDY FIELDS. I. GEOGRAPHICAL DISTRIBUTION, CHARACTERISTICS AND CLASSIFICATION OF SOILS IN MIYAGI PREFECTURE. Soil and Plant Food. 4(2): 83-92. maps. Sept. 1958. 56.8 So38

The distribution of peaty paddy fields, species of peats, soil profiles, physical and chemical characteristics and the classification of peaty soils were given for the Miyagi Prefecture in Japan.

1045. Talsma, T. COMPARISON OF FIELD METHODS OF MEASURING HYDRAULIC CONDUCTIVITY. Cong. Irrig. and Drain. Trans. 4(6): C.145-C.156. Ref. 1960. 55.9 C7652

Field measurements of hydraulic conductivity made by the well permeameter, piezometer and augerhole methods were reported. Measurements were made on small, relatively uniform test sites, covering a variety of soil types in New South Wales.

The augerhole and piezometer methods gave comparable values of hydraulic conductivity on sites where the depths of the respective soil samples approximately coincided.

1046. Talsma, T. MEASUREMENT OF SOIL ANISOTROPY WITH PIEZOMETERS. J. Soil Sci. 11(1): 159-171. Ref. Mar. 1960. 56.8 J823

A report was given on the measurement of soil anisotrophy in Australia with piezometers.

1047. Talsma, T. METHOD OF MEASURING WATER-TABLE DEPTH AND PRESSURE LEVELS. Cong. Irrig. and Drain. Trans. 5(5): R.17.1-R.17.11. 1963. 55.9 C7652

A discussion was given on the various methods used to measure water-table fluctuations, at time intervals of approximately 1 day.

1048. Talsma, T., and Flint, S. E. SOME FACTORS DETERMINING THE HYDRAULIC CONDUCTIVITY OF SUBSOILS WITH SPECIAL REFERENCE TO TILE DRAINAGE PROBLEMS. Soil Sci. 85(4): 198-206. Ref. Apr. 1958. 56.8 So3

An investigation of the hydraulic conductivity of subsoil material below a depth of about 3 feet was made in South Wales. Soil texture was found to be the most important property determining hydraulic conductivity. In materials of similiar texture, hydraulic conductivity decreased with depth below the surface. This phenoma was more pronounced in materials of heavy texture, and was only slight in materials of very light texture.

1049. Tamai, T., Jodo, S., Takusuka, T., and Imanishi, T. FUNDAMENTAL STUDIES OF IRRIGATION OF UPLAND FIELDS. VI. SOME WATER ABSORPTION CHARACTERISTICS OF PADDY RICE PLANTS CULTIVATED IN UPLAND FIELDS IN EARLY SEASON. (Ja) Crop Sci. Soc. Japan Proc. 27(2): 261-265. Dec. 1958. 22.5 C88
English summary.

Research was reported on the water absorption characteristics of paddy rice plants in cultivated irrigated upland fields in Japan. The water absorption by paddy rice in the early season was very similiar to that reported on upland rice when grown on these irrigated upland fields. The water needed by the paddy rice in these upland fields was about 700 times the volume of the rice produced.

1050. Tamboli, P. M., and Pathak, N. K. S. STUDIES ON THE SALINE AND ALKALI SOILS OF MADHYA. Pradesh. Indian Soc. Soil Sci. J. 12(3): 195-202. Sept. 1964. 56.9 In2

The results were given of morphological, mechanical, and chemical properties of typical soil profiles, and some surface samples of saline and alkali soils in India.

1051. T'ao, K. T. THE SALINIZATION OF THE SOILS IN THE CHIN-CHUNG THREE RIVER IRRIGATION AREA; THE CAUSES OF DESALINIZATION AND THEIR IMPROVED USE. (Ch) Turang Tongbao. 4: 6-11. map. Aug. 1963. 56.8 T792

1052. Taylor, G. S., Goins, T., and Holowaychuk, N. DRAINAGE CHARACTERISTICS OF TOLEDO AND HOYTVILLE SOILS. Ohio Agr. Expt. Sta. Res. B. 876, 23 pp. Ref. May 1961. 100 Oh3S

A detailed report was given on drainage characteristic of Toledo and Hoytville soils in Ohio.

1053. Taylor, H. M. MOISTURE RELATIONSHIPS OF SOME RANGELAND SOILS OF THE SOUTHERN GREAT PLAINS. J. Range Mangt. 13(2): 77-80. 1960. 60.18 J82

A report was given on the moisture relationships of eight soil types in the Southern Great Plains.

1054. Taylor, S. A. FIELD DETERMINATIONS OF SOIL MOISTURE. Agr. Engin. 36: 654-659. Ref. Oct. 1955. 58.8 Ag83

A comparison of several methods of measuring moisture showed that none of the presently available field methods were completely satisfactory.

The large errors reported in field studies with tensiometers, resistance units, neutron method, and gravimetric sampling are largely a result of real variation of moisture in the field.

In order to determine accurately, the moisture content of any plot or field at any time, a large number of samples should be taken. Fewer samples were required for the gravimetric method than for the resistance or neutron methods in order to give any desired degree of precision.

1055a. Taylor, S. A. HOW WATER MOVES IN SOIL. Farm and Home Sci. [Utah Sta.] 18(4): 84-85, 100. Dec. 1957. 100 Ut1F

Descriptions and illustrations were given on how water moves in the soil.

1055b. Taylor, S. A. MEASURING SOIL-WATER POTENTIAL. In METHODOLOGY OF PLANT ECOLOGY: PROCEEDINGS OF THE MONTPELLIER SYMPOSIUM 1962. Arid Zone Res. 25: 149-157. 1965. 278.9 Un3

Studies were reported that showed that temperature, moisture content, density, and composition all influence the soil water potential.

1056. Taylor, S. A., and Cary, J. W. LINEAR EQUATIONS FOR THE SIMULTANEOUS FLOW OF MATTER AND ENERGY IN A CONTINUOUS SOIL SYSTEM. Soil Sci. Soc. Amer. Proc. 28(2): 167-172. Mar./Apr. 1964. 56.9 So3

Some transfer processes in soil were considered with respect to recent developments in the theory of thermodynamics of irreversible processes. The theory provides a general and systematic guide for setting up interrelated equations describing the transport of one or more components through soil. Darcy's law and the "diffusion equation" were shown to be components of this general development. Particular attention was given to the nonisothermal flow of moisture and energy through soil. A general relation between the fluxes induced by the combined gradients of moisture content, temperature, and solutes was also suggested.

1057. Taylor, S. A., and Cary, J. W. SOIL-WATER MOVEMENT IN VAPOR AND LIQUID PHASES. In METHODOLOGY OF PLANT ECOLOGY: PROCEEDINGS OF THE MONTPELLIER SYMPOSIUM 1962. Arid Zone Res. 25: 159-165. 1965. 278.9 Un3

A discussion was given on soil-water movement in vapor and liquid phases.

1058. Taylor, S. A., Evans, D. D., and Kemper, W. D. EVALUATING SOIL WATER. Utah Agr. Expt. Sta. B. 426, 67 pp. June 1961. 100 Ut1

The theoretical basis was given for the methods used in measuring soil water. Methods and procedures were given in sufficient detail that a good technician could use the methods and in some cases make his own apparatus and equipment where satisfactory equipment was not available commercially.

1059. Taylor, S. A., and Haddock, J. L. SOIL MOISTURE AVAILABILITY RELATED TO POWER REQUIRED TO REMOVE WATER. Soil Sci. Soc. Amer. Proc. 20: 284-288. 1956. 56.9 So3

A deficit of water in plant root tissues sets up forces across the root surface membrane causing movement of water into the plant. As the removal increases, the forces get stronger; this normally causes water to move into the plant rapidly. The work per unit time that must be expended to remove a unit volume of water from the soil is here defined as the water extracting power.

Some theoretical predictions were made and partially verified by experiment.

1060. Terasawa, S. STUDIES ON THE MOVEMENT OF WATER IN UPLAND SOILS. VII. EFFECTS OF THE THICKNESS OF SOIL LAYER UPON THE MOISTURE CONDITION OF SURFACE SOIL. (Ja) J. Sci. Soil and Manure. 33(1): 553-557. 1962. 56.8 J27
English abstract—Soil Sci. and Plant Nutr. 9(3): 40-41. May 1963. 56.8 So38

Studies in Japan were reported on the effect of the thickness of soil layers on the moisture condition of the surface in upland soils.

1061. Terasawa, S. STUDIES ON THE MOVEMENT OF WATER IN UPLAND SOILS. VI. MOVEMENT OF SOIL STRUCTURS [STRUCTURES] IN THE PROFILE. (Ja) J. Sci. Soil and Manure. 33(11): 557-561. 1962. 56.8 J27
English abstract—Soil Sci. and Plant Nutr. 9(3): 40-41. May 1963. 56.8 So38

Studies in Japan were reported on the effect of soil structures in the profile on the soil moisture movement in upland soils.

1062. Terasawa, S., and Koga, T. DETERMINATION OF SOIL MOISTURE TENSION BY PRESSURE MEMBRANE METHOD. (Ja) J. Sci. Soil and Manure. 34(9): 354. Sept. 1963. 56.8 J27

1063. Thames, J. L. MEASURING SOIL MOISTURE OVER LARGE AREAS WITH SINGLE INSTALLATIONS OF MOISTURE UNITS. J. Geophys. Res. 64(2): 257-262. Ref. Feb. 1959. 470 J823

It seems possible that, with proper calibration, single installations of electrical soil-moisture units can be used to estimate moisture contents of outlying sites receiving similar amounts of rain but differing in vegetation and soils. In tests with data from northern Wisconsin and west-central Mississippi, predicted moisture contents agreed closely with those obtained by on-site measurements. Results were most accurate at seasons when the soils remained near the wilting point or near field capacity and were least accurate during periods of recharge.

1064. Theron, J. J. LYSIMETER TRIALS. II. 1945-1961. (Af) So. African J. Agr. Sci. 7(1): 109-122. Mar. 1964. 24 Su3
English summary.

A report was given on lysimeter trials at the University of Pretoria in South Africa during 1945-1961.

1065. Thiel, T. J., Fouss, J. L., and Leech, A. P. ELECTRICAL WATER PRESSURE TRANSDUCERS FOR FIELD AND LABORATORY USE. Soil Sci. Soc. Amer. Proc. 27(5): 601-602. Sept./Oct. 1963. 56.9 So3

A simple electrical water pressure transducer was described which has been designed and constructed for the purpose of measuring hydrostatic pressures in porous media. It employs a stainless steel sensing diaphragm and a linearly variable differential transformer.

1066. Thorne, M. D., and Raney, W. A. SOIL MOISTURE EVALUATION. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-6, 10 pp. May 1956. A56.9 R31

The work which a plant root must do in order to extract water from the soil gives an accurate measurement of the availability of the soil moisture to the plant. Different methods of measuring the work required for a plant to extract water from the soil were described.

The characteristics of an ideal soil moisture measuring device for making field measurements of soil moisture were given along with different principles used to measure soil moisture in place.

1067. Thornton, J. F., and Beasley, R. P. CHARACTERISTICS OF FLOW IN TRAPEZOIDAL AND TRIANGULAR IRRIGATION FURROWS. Mo. Agr. Expt. Sta. Res. B. 855, 36 pp. 1964. 100 M693

The characteristics of flow in irrigation furrows, as influenced by furrow shape, roughness, slope, and rate of flow were investigated.

Hydraulic tests were conducted in a flume 30 feet long, 3.33 feet wide, and 1.66 feet deep. Furrows with trapezoidal and triangular shapes were formed in the flume.

Tests were run on four different roughnesses, using five rates of flow and six slopes. The furrows were constructed of aluminum and lined with silt or sand to provide different degrees of roughness. Additional tests were run using furrows of the above-mentioned shapes formed in soil. During one series of tests, water was removed from the soil by a vacuum system to maintain infiltration. Another series was run without infiltration. Tests on furrows in soil were also run with five rates of flow and six slopes.

1068. Till, M. R. WATER IN SOIL. So. Austral. Dept. Agr. J. 64(7): 309-310. Feb. 1961. 23 So84

A discussion was given on water use and water movement in the soil.

1069. Till, M. R. TENSIOMETERS. I. So. Austral. Dept. Agr. J. 64(9): 394-396. Apr. 1961.

A description was given of tensiometers to measure soil moisture in Australia.

1070. Till, M. R. TENSIOMETERS. II. So. Austral. Dept. Agr. J. 64(10): 453-457, 460. May 1961. 23 So84

A report was given on the use of soil tensiometers to measure soil moisture for irrigation in Australia.

1071. Till, M. R. TENSIOMETERS. III. So. Austral. Dept. Agr. J. 64(11): 495-496. June 1961. 23 So84

A report was given on the construction of soil tensiometers for soil moisture measurement in Australia.

1072. Tishchenko, V. A. APPARATUS FOR DETERMINATION OF SOIL MOISTURE. (Rus) Sadovodstvo. 1961(7): 26. July 1961. 80 Sa13

1073. Tolpa, S. THE CAUSES AND MECHANISM OF DEVELOPMENT OF TRANSITIONAL AS WELL RAISED BOG IN NORTHEAST PART OF POLAND. Zeszyty Prob. Postepow Nauk Roln. 25: 7-77. maps. 1960. 20.5 Z5

A report was given on the genesis of transitional and raised bogs in the northeast part of Poland.

1074. Tomashevskii, I. I. BOG SOILS AND CONDITIONS OF THE ENVIRONMENT. (Rus) Pochvovedenie. 5: 1-11. May 1957. 57.8 P34
English summary.

The bog process, dominating in swampy soils, consists of a gradual deacidification, transformation, and redistribution of the soil mass as a result of interaction of physical, chemical, and biological factors.

In bog soils, joint action of precipitates, surface runoff, and ground water reveals itself.

When absolute anaerobiosis dominate, peat is formed at the surface and gley in the lower soil horizon. When periodic changes of relative and absolute anaerobiosis occurs in the upper part of the soil profile, marsh forming processes are developed.

1075. Tovey, R., and Bianchi, W. C. POSITIVE WATER-LEVEL CONTROL IN CONSUMPTIVE USE STUDIES. Trans. ASAE 4(1): 126-127. 1961. 290.9 Am32T

A report was given on the development and use of a positive water lever control for lysimeters research on consumptive use and yield of alfalfa grown under high water table conditions in Nevada.

1076. Trist, P. J. O. THE SUFFOLK COASTAL MARSHES AND THEIR RELATION TO THE SANDLANDS. Agr. Prog. 38: 34-39. 1963. 10 Ag86

A report was given on coastal marshes of Suffolk, England, and their relation to the sandlands.

1077. Turc, L. EVAPORATION AND DRAINAGE IN LYSIMETERS IN THE FIELD AND IN CATCHMENTS. (Fr) In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 75-83. Ref. 1959. 292.9 As7C

1078. Twersky, M., and Hillsman, G. CONTROL OF SOIL MOISTURE REGIMES IN GREENHOUSE STUDIES BY THE NEUTRON METHOD. Soil Sci. Soc. Amer. Proc. 25(1): 13-14. 1961. 56.9 So3

A calibration curve for measurement of soil moisture regimes by the neutron method was shown for a greenhouse study. A linear regression analysis was used to determine the equation for the best fitting neutron-soil moisture data. The equation was established by relating percent of neutron standard and tension in atmospheres. This relationship was determined as

$$\log T = c + bY$$

where T is tension in atmospheres and Y is percent of neutron standard.

1079. Ubell, K. MOISTURE MOVEMENT IN UNSATURATED (THREE-PHASE) SOILS, WITH SPECIAL REGARD TO THE UTILIZATION OF LYSIMETER OBSERVATIONS. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 153-165. Ref. 1959. 292.9 As7C

A discussion was given on the moisture movement in unsaturated (three-phase) soils in Hungary with special regard to the utilization of lysimeter observations.

1080. Uchiyama, N., and Onikura, Y. STUDIES ON CLAY FORMATION IN PADDY SOILS. IV. (Ja) J. Sci. Soil and Manure. 27(5): 202-206. Aug. 1956. 56.8 J27
English summary.

The influence of stagnation and drainage on clay minerals in paddy soils was given.

Stagnation seemed to promote the increase of halloysite and ferrosilicates of chlorites and the kaolin-group minerals. The drainage in winter seemed to break down the clay minerals formed during the stagnated summer.

1081. Uchiyami, N., and Onikura, Y. CLAY MINERALS IN CERTAIN PADDY FIELDS IN JAPAN. Cong. Internatl. de la Sci. du Sol. Rap. 6(C, colloque du Riz): 515-520. 1956. 56.09 In8452

A discussion was given on the clay minerals found in certain paddy fields in Japan.

1082. U.S. Agricultural Research Service. EVALUATION OF AGRICULTURAL HYDROLOGY BY MONOLITH LYSIMETERS. U.S. Dept. Agr., Agr. Res. Serv. Tech. B. 1179, 166 pp. 1959. 1 Ag84T

A progress report was given on lysimeter investigations carried on at the Soil and Water Conservation Research Station near Coshocton, Ohio, from 1944 through 1955. Summaries of percolation data were presented for the period 1938-55.

The hydrologic data were obtained from 11 monolith lysimeters, each 0.002 acre in area and 8 feet deep, 3 of which were weighed automatically every 10 minutes. The features of the installations were described briefly.

1083. U.S. Forest Service. HANDBOOK ON MEASUREMENT OF SOIL MOISTURE BY THE NEUTRON SCATTERING METHOD; A COMPILATION OF AVAILABLE INFORMATION FOR USE WITHIN U.S. FOREST SERVICE. Washington, 1962. 34 pp. Ref. 1962. A56.43 F76H

A handbook was given on the use of the neutron scattering method for soil moisture measurement.

1084. U.S. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 15; IRRIGATION—CHAPTER 1. SOIL-PLANT-WATER RELATIONSHIPS. 72 pp. 1964.

A discussion was given on those properties of soils and plants that affect the movement, retention, and use of the water essential to plant growth. Methods of measuring soil moisture were reported.

1085. Valk, U., and Valk, H. ON THE GENESIS OF KERRETI PEAT BOG. (Es) Akad. Nauk Estonskoi SSR. Izv. Ser. Biol. 1: 72-77. map. 1959. 442.9 Ak18
English summary.

A history of the genesis of the Kerreti Peat Bog in Estonia was given along with the results of soil investigations in the bog.

1086. Valle-Florencia, H. Del. SOIL MOISTURE READING USING GYPSUM AND THE "CHAPINGO 63" METER. (Sp) Ingen. Hidraul. en Mex. 18(1/2): 46-49. Jan./June 1964. 290.8 In43

1087. Van Bavel, C. H. M. NEUTRON AND GAMMA RADIATION AS APPLIED TO MEASURING PHYSICAL PROPERTIES OF SOIL IN IT'S NATURAL STATE. Cong. Internatl. de la Sci. du Sol. Rap. 6(B, comn. I): 355-360. 1956. 56.09 In8452

A report was given on the use of neutron and gamma radiation for the measurement of physical properties of soils.

1088. Van Bavel, C. H. M. MEASUREMENT OF SOIL MOISTURE CONTENT BY THE NEUTRON METHOD. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-24, 29 pp. Ref. Aug. 1958. A56.9 R31

Measurement of soil moisture by the neutron method was explained. A description was given of the equipment needed, its calibration, and its operation, along with the advantages and disadvantages.

1089. Van Bavel, C. H. M. SOIL DENSITOMETRY BY GAMMA TRANSMISSION. Soil Sci. 87(1): 50-58. Jan. 1959. 56.8 So3

A gamma transmission method for field measurement of the density of soil in situ was described. The equipment worked satisfactorily in the field when portable components were used.

1090. Van Bavel, C. H. M. DROUGHT AND WATER SURPLUS IN AGRICULTURAL SOILS OF THE LOWER MISSISSIPPI VALLEY AREA. U.S. Dept. Agr., Agr. Res. Serv. Tech. B. 1209, 93 pp. Dec. 1959. 1 Ag84Te

Daily soil-water balances were computed for 25 years of record and for 81 locations in the Lower Mississippi Valley area to show the drought and water surplus for the area.

1091. Van Bavel, C. H. M. SOIL DENSITY MEASUREMENT WITH GAMMA RADIATION. Trans. Internatl. Cong. Soil Sci. Trans. 7(I): 284-289. 1960. 56.09 In847T

The physical principles of soil densitometry by gamma transmission were discussed. It was shown how they can be applied to instrumental design problems such as gamma source selection, strength of source, distance to detector, anticipated precision and time of measurement. The disturbing effect of hydrogen in the soil was explained and analyzed.

1092. Van Bavel, C. H. M. LYSIMETRIC METRIC MEASUREMENTS OF EVAPOTRANSPIRATION RATES IN THE EASTERN UNITED STATES. Soil Sci. Soc. Amer. Proc. 25: 138-141. 1961. 56.9 So3

A review of various methods to determine the evapotranspiration rate under field conditions was given. It was shown that the data collected by a suitable lysimetric method were the only ones that exist in quantity, which could be considered reliable.

The conditions which must be met by a lysimeter installation for the accurate and representative measurement of the evapotranspiration rate were reviewed.

1093. Van Bavel, C. H. M. NEUTRON MEASUREMENT OF SURFACE SOIL MOISTURE. Journal Geophysical Research 66(12): 4193-4198. Dec. 1961. 470 J823

A neutron probe designed for the measurement of surface soil moisture was described. Adequate accuracy and sensitivity were reported for homogeneous surface soils.

1094. Van Bavel, C. H. M. ACCURACY AND SOURCE STRENGTH IN SOIL MOISTURE NEUTRON PROBES. Soil Sci. Soc. Amer. Proc. 26(4): 405. July/Aug. 1962. 56.9 So3

A note was given on the accuracy and source strength in soil moisture neutron probes.

1095. Van Bavel, C. H. M. LIGHT-WEIGHT RATE METER FOR NEUTRON SOIL MOISTURE MEASUREMENT. Soil Sci. 94(6): 418-419. Dec. 1962. 56.8 So3.

A light-weight rate meter for neutron soil moisture measurement was described and illustrated.

1096. Van Bavel, C. H. M. A FURTHER NOTE ON THE EFFICIENCY OF SOIL MOISTURE NEUTRON PROBES. Soil Sci. Soc. Amer. Proc. 27(5): 604. Sept./Oct. 1963. 56.9 So3

Additional data were given on the efficiency of soil moisture neutron probes.

1097. Van Bavel, C. H. M. NEUTRON SCATTERING MEASUREMENT OF SOIL MOISTURE: DEVELOPMENT AND CURRENT STATUS. In INTERNATIONAL SYMPOSIUM ON HUMIDITY AND MOISTURE, WASHINGTON, D.C., 1963. HUMIDITY AND MOISTURE. 4: 171-184. Ref. 1965. 291.9 In82

A report was given on the development and current status of the neutron scattering measurement of soil moisture.

1098. Van Bavel, C. H. M., and Myers, L. E. AN AUTOMATIC WEIGHING LYSIMETER. Agr. Engin. 43(10): 580-583, 586-588. Oct. 1962. 58.8 Ag83

An automatic weighing lysimeter was described and illustrated. Strain gages record weight automatically on punched paper tape. The system is electronic with remote recording.

1099. Van Bavel, C. H. M., Nielsen, D. R., and Davidson, J. M. CALIBRATION AND CHARACTERISTICS OF TWO NEUTRON MOISTURE PROBES. Soil Sci. Soc. Amer. Proc. 25(5): 329-334. Ref. Sept./Oct. 1961. 56.9 So3

The effect of the size of cylindrical containers filled with soil on the calibration of two types of neutron probes was investigated for moisture contents up to 0.25 volume fraction. A discussion was given of the range of measurement of soil moisture content with neutron probes.

1100. Van Bavel, C. H. M., Nizon, P. R., and Hauser, V. L. SOIL MOISTURE MEASUREMENT WITH THE NEUTRON METHOD. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-70, 39 pp. Ref. June 1963. A56.9 R31

A detailed discussion was given on the use of the neutron method of soil moisture measurement.

1101. Van Bavel, C. H. M., and Reginato, R. J. PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX. In METHODOLOGY OF PLANT ECOLOGY: PROCEEDINGS OF THE MONTPELLIER SYMPOSIUM 1962. Arid Zone Res. 25: 129-135. 1965. 278.9 Un3

A report was given on the use of weighing lysimeters to directly measure evaporative flux.

1102. Van Bavel, C. H. M., Underwood, N., and Ragar, S. R. TRANSMISSION OF GAMMA RADIATION BY SOILS AND SOIL DENSIOMETRY. Soil Sci. Soc. Amer. Proc. 21(6): 588-591. Nov./Dec. 1957. 56.9 So3

The theoretical basis for gamma densiometry of soil by transmission was reviewed.

1103. Van Bavel, C. H. M., Underwood, N., and Swanson, R. W. SOIL MOISTURE MEASUREMENT BY NEUTRON MODERATION. Soil Sci. 82: 29-41. Ref. July 1956. 56.8 So3

A report was given on the use of a portable instrument to measure soil moisture by measurement of slow neutron density in soils. Improvements were suggested to improve the method.

1104. Van Der Westhuizen, M. ON THE POSSIBILITY OF MEASURING SOIL MOISTURE WITH HIGH FREQUENCY ELECTRO-MAGNETIC WAVES. So. African J. Agr. Sci. 7(3): 589-590. Sept. 1964. 24 Su3

A research note was given on the use of high frequency electro-magnetic waves for measuring soil moisture in South Africa.

1105. Van't Woudt, B. D. INFILTRATION BEHAVIOR UNDER FURROW AND SPRINKLER IRRIGATION. Agr. Engin. 38: 310-311, 319-320. 1957. 58.8 Ag83

Relatively large cracks were found to cause uneven infiltration temporarily, but the effect of soil cracks was overcome as the opposite walls of the cracks cave together, caused by swelling of the surrounding soil. No movement into or through the cracks takes place unless the soil is in a saturated condition.

The pattern of moisture distribution in the soil appeared the same under both methods of irrigation, with the exception that the crest of the ridge between the furrows remained unwetted in the case of furrow irrigation.

Soluble salts in the surface soil are pushed toward the crest of the ridges in furrow irrigation, but under sprinkler irrigation the salts are pushed evenly down the profile.

Excessive discharge in the drain tile system in an area under furrow irrigation could not be attributed to the rapid movement of applied water through soil cracks, but appeared to be caused by continued irrigation after the soil was completely saturated to the depth of the drains.

1106. Veber, K. THE NUMBER OF MOORS IN THE ESTONIAN S.S.R. (Es) Eesti Loodus. 5: 266-270. Sept./Oct. 1963. 409.6 Ee7.
English summary.

There are nearly 7,000 moors of different sizes in Estonia and they cover an area of 908 thousand hectares or about 20 percent of the entire territory of the republic. The low-moor type makes up 57 percent of the moorland area, the transition swamps 12 percent, and the high-moor type 31 percent.

1107. Veber, K., Kurm, K., Laasimer, L., Raudsepp, A., and Truu, A. PEAT SUPPLIES OF ESTONIAN SSR. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 88-107. 1957. 56.33 R922

1108. Veihmeyer, F. J. SOIL MOISTURE. Handb. der Pflanzenphysiol. 3: 64-123. Ref. 1956. 463.3 H192

A review of the literature and a discussion was given for soil moisture and soil moisture measurement.

1109. Vetterlein, E. RESULTS OF RESEARCH ON THE WATER MOVEMENT IN SOILS WITH HELP OF THE VACUUM CAPILLARIMETER. (Ge) Albrecht-Thaer-Arch. 6(2): 118-127. 1962. 18 AL1
English summary.

Results of research in Germany were given on the water movement of soils measured by the two suction funnels.

1110. Vidmantas, I. P. MAIN REGIONS OF PEAT DEPOSITS IN LITHUANIAN SSR. (Rus) RSFSR. Glav. Upravlenie Torf. Fonda. Sborn. 2: 129-139. 1957. 56.33 R922

1111. Vimoke, B. S., and Taylor, G. S. SIMULATING WATER FLOW IN SOIL WITH AN ELECTRICAL RESISTANCE NETWORK. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-65, 51 pp. Oct. 1962. A56.9 R31

A method for calculating and assembling network resistances to represent water flow in soil was presented and discussed. The approach used was called the "building block" method.

1112. Visser, W. C. THE EXTENSION OF THE LYSIMETER TECHNIQUE INTO A FIELD METHOD FOR THE DETERMINATION OF THE WATER-BALANCE. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 146-152. 1959. 292.9 As7C

A report was given on the need to collect data on water content and water movement in lysimeters so that all the lysimeter data can be related to field use.

1113. Visser, W. C. SOIL MOISTURE SAMPLING AS A BASIS FOR A DETAILED DESCRIPTION OF MOISTURE UTILIZATION BY CROPS. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 16: 33-41. 1961. 278.9 Un3

A report was given on the use of soil moisture sampling in the Netherlands to form a basis for a detailed description of the moisture used by crops.

1114. Visser, W. C. A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS. In METHODOLOGY OF PLANT ECOLOGY: PROCEEDINGS OF THE MONTPELLIER SYMPOSIUM 1962. Arid Zone Res. 25: 453-460. 1965. 278.9 Un3

A discussion was given on a method of determining evapotranspiration in soil monoliths.

1115. Voisey, P. W., and Cooper, D. J. NOTE ON AN INSTRUMENT FOR MEASURING SOIL WATER LEVEL. Canad. J. Soil Sci. 42(1): 226-228. Feb. 1962. 56.8 C162

An instrument was described and illustrated that can be used for measuring soil water level for drainage and irrigation projects.

1116. Vomperskii, S. E. THE METHOD OF MAKING GROUNDWATER OBSERVATIONS IN FOREST-DRAINAGE INVESTIGATIONS. (Rus) Lesn. Zhur. 1: 48-52. 1964. 99.8 Iz8

1117. Vries, J. De, and King, K. M. NOTE ON THE VOLUME OF INFLUENCE OF A NEUTRON SURFACE MOISTURE PROBE. Canad. J. Soil Sci. 41(2): 253-257. Aug. 1961. 56.8 C162

An experiment was made to determine more specifically the effect of the volumetric moisture content on the vertical and horizontal dimension of the volume of influence of the neutron soil moisture probe. It was concluded that the size of the box recommended by the manufacturer was satisfactory for laboratory calibrations.

1118. Wack, B. RETRODIFFUSION RADIOACTIVE MEASUREMENT OF THE SPECIFIC WEIGHT AND MOISTURE OF SOILS. (Fr) Chatou. Cent. de Rech. et d'Essais. B. 7, pp. 3-18. Mar. 1964. 290.9 C39

1119. Wadleigh, C. H. OUR SOIL-MOISTURE RESERVOIR. Soil Conserv. 29(3): 59-60. Oct. 1963. 1.6 So3S

A discussion was given on our soil moisture reservoir.

1120. Wagner, G. H. USE OF POROUS CERAMIC CUPS TO SAMPLE SOIL WATER WITHIN THE PROFILE. Soil Sci. 94: 379-386. 1962. 56.8 So3

An apparatus was described for sampling soil water at various depths within the soil profile. It involves the use of porous ceramic cups placed in the soil. By reducing the pressure to a few mm. of mercury within these cups at times when moisture is held in the soil at tensions less than one atmosphere, water moves from the soil into the ceramic cup.

1121. Waldis, L. CLARIFICATIONS AND COMMENTS ON RECLAMATION OF THE SWAMPY LANDS OF THE PO DELTA. (It) Agr. Delle Venezie. 11(9): 506-508. Sept. 1957. 16 Ag826

1122. Walker, P. SOIL CORE METHOD IN VIRGINIA. Agr. Engin. 40(5): 270-271. May 1959. 58.8 Ag83

A report was given on the use of the soil core method to measure hydraulic conductivity of the soil in Virginia for the design of drainage systems.

1123. Wang, T. C., Liu, Y. C., Li, L. C., and Tung, C. P. THE CONDITIONS OF FORMATION OF SALINE SOILS IN LIACHENG, SHANTUNG AND THE SYSTEM OF THEIR DISTRIBUTION. (Ch) Acta Pedol. Sinica. 11(4): 343-360. map. Ref. 1963. 56.9 Ac8
Russian summary.

1124. Warnick, C. C. PROBLEMS IN SEEPAGE EVALUATION AND CONTROL. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Agr. Res. Serv. ARS 41-90, pp. 132-137. Jan. 1965. A56.9 R31
Discussion, pp. 150-152.

A report and the discussion were given on the problems of seepage evaluation and control.

1125. Warrior, S. K., and Pollard, A. G. ACTION OF SYNTHETIC SOIL-CONDITIONERS IN WATER-LOGGED SOILS. J. Sci. Food and Agr. 10(10): 565-568. Oct. 1959. 382 So12

A report was given on the use of synthetic soil conditioners on waterlogged soils in England.

1126. Was, S. FORMATION AND DEVELOPMENT OF LAYERS OF MOSS-PEAT IN THE PEAT-BOGS "PUPKOWIZNA" IN THE KURPIE DISTRICT. (Pol) Zeszyty Prob. Postepow Nauk Roln. 25: 79-98. map. Ref. 1960. 20.5 Z5
English summary.

A report was given of the formation and development of layers of moss-peat in some peat-bogs in the Kurpie District of Poland.

1127. Weeks, L. V., and Stolzy, L. H. NEUTRONS IN WATER-USE STUDIES. Calif. Agr. 12(12): 8. Dec. 1958. 100 C12Cag

Portable neutron equipment was described that permits measurement of soil moisture without injuring the plants or disturbing the soil.

1128. Weissenborn, K. OUR MARSH SOILS, THEIR PHYSICAL CHARACTERISTICS, ESPECIALLY THEIR DRAINAGE CAPACITY WITH REFERENCE TO FRUIT CULTURE. (Ge) Obstbauversring. des Alten Landes. Mitt. 15(10): 254-262. Oct. 1960. 85 J76

1129. Wertz, G. RELATIONS BETWEEN THE PHYSICAL SIZE OF PEAT AND MUD SOILS. (Ge) Z. f. Landeskult. 4(3/4): 247-250. 1963. 282.9 Z3
English summary.

The relations between the physical size of peat and mud soils were made to help determine which peat soils could be drained in Germany, and the load that they can support.

1130. Wesseling, J. SOME ASPECTS OF THE WATER GOVERNMENT IN AGRICULTURAL SOILS. (Du) Netherlands Dir. van de Landb. Verslagen van Landbk. Onderz. 63(5): 1-90. Ref. 1957. 105.2 V61V
English summary.

In the Netherlands, evapotranspiration during the winter is very small and a surplus of water occurs and drainage of most agricultural soil is necessary. During summer, evapotranspiration exceeds precipitation and a shortage of water occurs especially in light textured soils.

Tile drainage methods and research were given.

1131. Westerhof, J. J. SOIL STRUCTURE AND GYPSUM. (Du) T.N.O. - Nieuws. 11: 12-20. Jan. 1956. 475 T11

1132. White, E. M. CALCIUM-SOLODI OR PLANOSOL GENESIS FROM SOLODIZED-SOLONETZ. Soil Sci. 91: 175-177. 1961. 56.8 So3

Solonetzic soils with thin A_1-A_2 and columnar, textural, B horizons, but with vegetation superior to that of thin-surfaced solodized-solonetz, occur in southwest central South Dakota. Less than 10 percent of the exchangeable cations in the upper B horizon are sodium. Calcium from carbonates apparently replaces exchangeable sodium, so that the soil will not degrade to a solod but will develop planosolic characteristics.

1133. White, E. M., and Papendick, R. I. LITHOSOLIC SOLODIZED-SOLONETZ SOILS IN SOUTHWESTERN SOUTH DAKOTA. Soil Sci. Soc. Amer. Proc. 25: 504-506. 1961. 56.9 So3

Solonetzic soils with thin calcareous sola occur in southwestern South Dakota. These profiles develop from sodium rich calcareous bedrock shortly after the bedrock is exposed by erosion.

1134. Whittig, L. D. ALKALI SOILS. In California University Extension Division. FARM MANAGEMENT SEMINAR FOR BANK OF AMERICA OFFICERS. Calif. U. Ext. Serv., Davis, Calif., pp. 16-21. 1959. 281.12 C12

A discussion was given on: Alkali soils in California; how they are classified; and how they can be reclaimed.

1135. Whittig, L. D. CHARACTERISTICS AND GENESIS OF A SOLODIZED-SOLONETZ OF CALIFORNIA. Soil Sci. Soc. Amer. Proc. 23: 469-473. 1959. 56.9 So3

Field and laboratory studies of a soil (Solano series) of the lower Sacramento Valley characterize it as a solodized-solonetz. The profile has a sharply delineated, alkaline, fine-textured, columnar B horizon below an acid, medium-textured A horizon. Remnants of an older columnar B horizon persist in the present upper leached portion of the soil.

Soluble salts and free carbonates and much of the clay have been leached from the upper 15 inches of the profile, but are present in appreciable concentrations below this level. Na is the predominant soluble cation. Of the exchangeable bases, Mg is dominant throughout the profile, increasing markedly with depth. Exchangeable Na is low near the surface and increases with depth at a slightly faster rate than does Mg.

1136. Whittig, L. D., and Janitzky, P. MECHANISMS OF FORMATION OF SODIUM CARBONATE IN SOILS: I. MANIFESTATIONS OF BIOLOGICAL CONVERSIONS. J. Soil Sci. 14: 322-333. 1963. 56.8 J823

Mechanisms of formation and accumulation of Na_2CO_3 were studied in a graded sequence of salt-affected soils of the Sacramento Valley, Calif. The soils are confined within a drainageway which is inundated during winter with flood waters containing relatively low concentrations of neutral sodium, calcium, and magnesium salts. Heavy inundations and high water tables within the basin led to microbiological reduction of sulfate and ferric iron. The resulting sulfide is held within the soil as FeS whereas the CO_2 released by biological oxidation of abundant organic matter forms bicarbonate.

1137. Wieringa, K. T. THE HUMINIFACTION [HUMIFICATION] OF HIGH-MOOR PEAT: I. CHANGES IN ION-EXCHANGE CAPACITY AND NITROGEN CONTENTS OF THE ORGANIC MATTER IN HIGH-MOOR PEAT. Plant and Soil. 18: 53-69. 1963. 450 P696

Changes in ion-exchange capacity and N-content of the organic matter occurred when high-moor peat was composted at room temperature. The ion-exchange capacity increased slowly.

Nitrogen was incorporated into the organic matter when the peat was composted with mineral fertilizers and N was applied as urea. The fixed nitrogen was not exchangeable with $BaCl_2$ or $Al_2\ (SO_4)_3$. It was assumed that micro-organisms played a part in this fixation.

Nitrogen losses occurred when, because of the nitrification process, the pH values dropped below 5.5.

1138. Wilcox, J. C. RATE OF SOIL DRAINAGE FOLLOWING AN IRRIGATION. II. EFFECTS ON DETERMINATION OF RATE OF CONSUMPTIVE USE. Canad. J. Soil Sci. 40(1): 15-27. Ref. Feb. 1960. 56.8 C162

An investigation was conducted in Canada to determine the effects of soil drainage and other factors on consumptive use as measured by soil sampling procedure. The author concluded that no reliable method has yet been developed for routine determination of the rate of consumptive use by soil sampling.

1139. Wilcox, J. C. NOTE ON EFFECTS OF WETTING AND DRYING ON READINGS OF ELECTRICAL RESISTANCE BLOCKS IN SOIL. Canad. J. Soil Sci. 41(2): 250-252. Ref. Aug. 1961. 56.8 C162

A test was made to study the effects of wetting and drying on readings of electrical resistance blocks in the soil. In these tests, no change was noted under continual use.

1140. Wilcox, J. C. RATE OF SOIL DRAINAGE FOLLOWING AN IRRIGATION. III. A NEW CONCEPT OF THE UPPER LIMIT OF AVAILABLE MOISTURE. Canad. J. Soil Sci. 42(1): 122-128. Ref. Feb. 1962. 56.8 C162

The upper limit of available moisture was defined as the highest moisture content that includes all moisture available for consumptive use but excludes all drainage below the root level. Sampling of the soil at 1 to 4 days after an irrigation, depending on the soil texture, gave a close approximation to the upper limit.

1141. Wilcox, J. C. RATE OF SOIL DRAINAGE FOLLOWING AN IRRIGATION. IV. EFFECTS OF CONSUMPTIVE USE AND SOIL DEPTH ON UPPER LIMIT OF AVAILABLE MOISTURE. Canad. J. Soil Sci. 42(1): 129-136. Feb. 1962. 56.8 C162

A report was given on the effect of consumptive use and soil depth on upper limit of available moisture.

1142. Wilcox, L. V. FACTORS FOR CALCULATING THE SODIUM-ADSORPTION-RATIO SAR. U.S. Salinity Laboratory, 6 pp. June 1963.

Factors were given for calculating the Sodium-Adsorption-Ratio (SAR).

1143. Wilding, L. P., Odell, R. T., Fehrenbacher, J. B., and Beavers, A. H. SOURCE AND DISTRIBUTION OF SODIUM IN SOLONETZIC SOILS IN ILLINOIS. Soil Sci. Soc. Amer. Proc. 27(4): 432-438. Ref. July/Aug. 1963. 56.9 So3

A report was given on possible sources of sodium and the distribution of sodium in solonetzic soils in Illinois.

1144. Willardson, L. S., and Taylor, S. A. SOIL SAMPLER FOR DIRECT MOISTURE DETERMINATION. Agr. Engin. 43(1): 33-34. Jan. 1962. 58.8 Ag83

A small diameter sampler designed for taking soil samples for bulk density and percent of volume was described and illustrated.

1145. Willey, C. R., and Tanner, C. B. MEMBRANE-COVERED ELECTRODE FOR MEASUREMENT OF OXYGEN CONCENTRATION IN SOIL. Soil Sci. Soc. Amer. Proc. 27: 511-515. 1963. 56.9 So3

The membrane-covered polarographic electrode was modified to permit a continuous in situ measurement of the oxygen concentration (partial pressure) of soil air. General design features of the probe and example measurements were presented.

1146. Williamson, R. E. THE MANAGEMENT OF SOIL SALINITY IN LYSIMETERS. Soil Sci. Soc. Amer. Proc. 27(5): 580-583. Sept./Oct. 1963. 56.9 So3

A report was given on the methods used to keep soil salinity at a low level in lysimeters used for drainage requirements of crops in North Carolina.

1147. Wilson, C. L. A PIEZOMETRIC FIELD STUDY OF SOIL WATER MOVEMENT TOWARD TILE DRAINS IN A NAPPANEE SILTY CLAY LOAM. Diss. Abs. 21(4): 713-715. Oct. 1960. 241.8 M58

An abstract was given on a piezometric field study in Ohio on the soil water movement toward tile drains in a Nappanee silty clay loam.

1148. Wind, G. P. NYLON ELEMENTS AS SOIL MOISTURE METERS. (Du) Landbk. Tijdschr. 67: 541-551. Ref. Aug. 1955. 105.2 Or3

1149. Wind, R. THE LYSIMETERS IN THE NETHERLANDS; DESCRIPTION OF THE LYSIMETERS WITH A REVIEW OF THE RECORDS TO 1954; REPORT TO THE COMMITTEE ON HYDROLOGICAL RESEARCH T.N.O. FOR THE WORKING PARTY ON LYSIMETERS. Cent. Organ. v. Toegepast-Natwetensch. Onderz. Verslagen van de Tech. Bijeenkomsten. 11/12: 165-228. 1955-56, pub. 1958. 292.9 C33

A report was given on lysimeter research in the Netherlands.

1150. Winger, R. J. IN-PLACE PERMEABILITY TESTS AND THEIR USE IN SUBSURFACE DRAINAGE. Cong. Irrig. and Drain. Trans. 4(3): 11.417-11.469. Ref. 1960. 55.9 C7652

Detailed descriptions were given of the following four methods to determine soil permeability in place: Auger-hole; Piezometer; pump-in; and permeameter. Adaptions which experience has shown to be more practical were presented.

1151. Winger, R. J., Jr. SHALLOW WELL PUMP-IN AND AUGER-HOLE METHODS IN COLORADO. Agr. Engin. 40(5): 273-280. May 1959. 58.8 Ag83

A report was given on the determination and use of the shallow well pump-in method and the Auger-hole methods for measuring hydraulic conductivity of the soil for the design of drainage systems.

1152. Winter, E. J. LOW-COST WEIGHABLE LYSIMETERS. Nature [London] 196(4861): 1341-1342. Dec. 29, 1962. 472 N21

A report was given on the use of some low-cost weighable lysimeters in England.

1153. Winter, E. J. A NEW TYPE OF LYSIMETER. J. Hort. Sci. 38(2):160-168. Ref. Apr. 1963. 80 J825

Two "weighing type" lysimeters, developed in England, were described that are: Simple and easy to build; free from danger of leaks; and transportable.

1154. Winter, E. J. A VALVELESS SOIL MOISTURE DEFICIT INDICATOR. J. Agr. Engin. Res. 8: 252-255. 1963. 56.8 J82

A valveless soil moisture deficit indicator was described in which the evaporating surface consists of a cylindrical jute wick arranged centrally within the receiving funnel and drawing its water supply from the rain receiver by capillarity. When necessary, a special mask was used to reduce evaporation rate from the wick without affecting the rate at which it collects incident rainwater.

Under test, a group of instruments gave readings in close agreement, and the deficit they indicated was satisfactorily related to the cumulative soil moisture deficit estimated from meteorological records.

By attaching suitable sensor devices, the instrument could be used for automatic control of irrigation equipment or for providing remote warning of excessive runoff in catchment areas.

1155. Winter, E. J., Salter, P. J., and Stanhill, G. LYSIMETRY AT THE NATIONAL VEGETABLE RESEARCH STATION, WELLESBOURNE, WARWICK, ENGLAND. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 43-44. Ref. 1959. 292.9 As7C

A report was given of the measurement of potential and actual evapotranspiration by small weighable lysimeters and Garnier transpirometers in England.

1156. Winterkorn, H. F., ed. WATER AND ITS CONDUCTION IN SOILS. National Res. Council, Highway Res. Board Sp. Rpt. 40, 338 pp. Ref. 1958. 292 W733

The papers were given that were presented at the international symposium on water and its conduction in soils at Washington, D.C., in 1958.

1157. Xabregas, J. SALINE SOILS-ALKALINE SOILS. (Po) Gaz. Agr. de Angola. 5(11): 611-613. May 1961. 24 G252

1158. Yaalon, D. H. ON THE ORIGIN AND ACCUMULATION OF SALTS IN GROUND-WATER AND IN SOILS OF ISRAEL. Hebrew U. Jerusalem, Dept. Geol. P. 255, 42 pp. 1961.

The problem of the source of soluble salts in ground water and in soils of Israel was examined and analyzed.

1159. Yaalon, D. H. THE ORIGIN AND ACCUMULATION OF SALTS IN GROUNDWATER AND IN SOILS OF ISRAEL. Israel Res. Council. B. 11G(3): 105-131. Ref. Jan. 1963. 330.9 Is72B

The problem of the source of soluble salts in ground water and in soils of Israel was examined and analyzed.

1160. Yakovlev, I. S. DETERMINATION OF THE CORRESPONDENCE BETWEEN WATER THROWN OFF FROM IRRIGATION FIELDS AND DRAINAGE WATERS WITH A COMPUTATION OF THEIR MINERALIZATION. (Rus) Akad. Nauk Tadzhikskoi SSR. Dok. 3(2): 23-26. 1960. 511 Ak193D

1161. Yamamoto, T. SOIL MOISTURE CONSTANTS AND PHYSICAL PROPERTIES OF SELECTED SOILS IN HAWAII. U.S. Forest Serv. Res. Paper PSW-P2, 10 pp. 1963. A99.9 F7652P

Soils from 34 sites representing 10 great soil groups common in Hawaii were analyzed for soil moisture constants and physical properties.

1162. Yamazaki, F., Yawata, T., Nagata, N., Tabuchi, T., and Iwata, S. NEW METHOD FOR MEASURING PERCOLATION WATER IN PADDY FIELDS. (Ja) Nogyodoboku-Kenkyu. 27(6): 381-386. Feb. 1960. 290.8 N68
English summary.

A new method was given for measuring percolation waters in paddy fields in Japan.

1163. Yamazaki, F., Yawata, T., Tabuchi, T., and Ishikawa. PERCOLATION THROUGH RIDGE AND INSIDE AREA OF PADDY FIELDS. (Ja) Norgyodoboku-Kenkyu. 29(7): 309-314. Feb. 1962. 290.8 N68
English summary.

A report was given on a study of the percolation through ridges and inside areas (surface soil, pan layer, subsoil) of a paddy field in Japan.

1164. Yamazaki, F., Yawata, T., Tabuchi, T., Ishikawa, T., and Nagasaki, A. STUDIES ON THE SEEPAGE IN PADDY FIELDS WITH GRAVEL LAYER IN THEIR SUBSOILS. (Ja) Nogyodoboku-Kenkyu. 29(1): 9-18. June 1961. 290.8 N68
English summary.

A report was given of a study of the seepage of paddy fields in Japan that have a gravel layer in their subsoils.

1165. Yamazaki, K. ON THE PADDY SOIL FORMING PROCESS. (Ja) Pedologist. 8(1): 1. June 1964.
56.8 P344

1166. Yarovenko, V. V. NEW METHODS FOR DETERMINATION OF MOISTURE SUPPLY IN SOILS. (Rus)
Vest. Sel'skokhoz. Nauk [Moscow] 7: 133-135. July 1963. 20 V633
English summary.

A method was proposed for the depth of sampling for soil moisture measurement.

1167. Yarvela, K. A. USE OF GAMMA RAYS FOR THE STUDY OF MOISTURE REGIME OF THE DRAINED SOILS.
(Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 107-116.
Ref. 1962. 20 M857

1168. Yarvela, K. A. EVALUATION OF ACCURACY OF NEUTRON METHOD OF MEASURING SOIL MOISTURE UNDER
FIELD CONDITIONS. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 46: 171-184. Ref. 1962.
106 P44
English summary.

A report was given of a comparison made in the U.S.S.R. between the neutron method and the oven-drying method for measuring soil moisture.

1169. Yarvela, K. A. NEW METHOD OF CALIBRATION OF NEUTRON SOIL MOISTURE METERS. (Rus)
Timiryazevskaya Sel'skokhoz. Akad. Izv. 49: 195-208. Ref. 1962. 106 P44
English summary.

A new method was described of calibration of neutron soil moisture meters by special equivalents of soil moisture in the U.S.S.R.

1170. Yesilkoy, S. MANUFACTURE OF SIMPLE TENSIOMETERS AND GYPSUM BLOCKS AND THEIR USE FOR
IRRIGATION PURPOSES. Near East-S. Afr. Irrig. Pract. Seminar. [Proc.] 5: 443-447. Ref.
1964. 173.2 In8Reg

A report was given on the manufacture and use of simple tensiometers and gypsum blocks for soil moisture measurement in Turkey.

1171. Yi, H. Y. THE AUGER HOLE METHOD FOR FIELD MEASUREMENTS OF THE HYDRAULIC CONDUCTIVITY OF
SOIL BELOW THE WATER TABLE. (Ko) J. Agr. Engin. 6(1): 8-16. May 1964. 290.9 T12

1172. Ying, L. A PRELIMINARY STUDY OF PEAT-BOGS ON MOUNT HSISHAN NEAR NANCHNAG, KIANGSI
PROVINCE. (Ja) Acta Bot. Sinica. 5: 15-32. Ref. 1956. 450 C432
English summary.

A study was reported on peat bogs on Mount Hsishan in Japan.

1173. Yoneda, S., and Ikehasu, S. A STUDY OF POLDER SOILS IN JAPAN. VII. EFFECT OF IRON
SULFIDES ON PROCESSES OF SOIL GENESIS OF HALOGENETIC POLDER SOILS. (Ja) J. Sci. Soil
and Manure. 26: 109-112. Aug. 1955. 56.8 J27
English summary.

A report was given on the effect of iron sulfides on soil formation in polder in Japan.

1174. Yoneda, S., Kawada, N., and Kochi, T. A STUDY ON POLDER SOILS IN JAPAN. VI. ON THE SOIL
TYPES AND ITS CHARACTERISTICS OF THE HALOGENETIC POLDER SOILS OF THE INNER KOJIMA BAY.
(Ja) J. Sci. Soil and Manure. 26: 57-62. July 1955. 56.8 J27
English summary.

The soil forming processes were studied of halogenetic polder soils developed along the sea coast of the inner Kojima Bay in Japan. The distribution of soil types and the characteristics of these soils were investigated.
The pH of the soils varied from pH3 to slightly alkaline.

1175. Yoneda, S., and Kochi, T. A STUDY ON POLDER SOILS IN JAPAN. XIII. DETERMINATION OF
ELECTRICAL CONDUCTIVITY OF SOIL EXTRACTS AND ITS USE IN APPRAISING SOIL SALINITY. (Ja)
Okayama. U. Facul. Agr. Sci. Rpt. 11: 1-14. Ref. Mar. 1958. 107.6 Ok12
English summary.

A study was reported of the use of electrical conductivity to determine the salt content and to evaluate the salt toxicity in soils in Japan. Electrical conductivity was measured for the saturation extracts of Fukuda polder soils and salty paddy soils.

A close relationship was found to exist between the pH of incubated soils and yield of rice. It appears that a large amount of sulfide accumulated in the salty paddy soils affects the crop growth.

1176. Yoneda, S., Shimose, N., and Kochi, T. RECLAMATION OF PHYSICAL PROPERTIES OF KOJIMA POLDER SOILS. (Ja) Okayama Agr. Expt. Sta. Spec. B. 54, pp. 1-20. Mar. 1956. 107.6 Ok1R
English summary.

Greenhouse and field experiments were reported on the influence of gypsum, calcium chloride, and sulfuric acid on the physical and chemical properties of Kojima heavy clay polder soils in Japan over a 2 year period.

1177. Yu, W. W., and Sung, Y. H. A DEVICE FOR COLLECTING UNDERGROUND MOISTURE SAMPLES AND HOW TO USE IT. (Ch) Acta Pedol. Sinica. 10(3/4): 401-404. Sept./Dec. 1962. 56.9 Ac8.
Russian summary.

1178. Yuan, T. W. THE MEASUREMENT OF SOIL PERCOLATION. (Ch) Turang Tongbao. 4: 55-59. Aug. 1963. 56.8 T792

1179. Yuldashev, A. LYSIMETERS FOR STUDYING WATER-SALT REGIME OF SOILS. (Rus) Sel'sk. Khoz. Tadzhikistana. 1961(9): 49-50. Sept. 1961. 20 Se494

1180. Zaidel'man, F. R. REGIONAL SUBDIVISION OF RECLAIMED WATER-LOGGED SOILS IN NON-CHERNOZEM ZONE AND SOME PROBLEMS OF THEIR STUDY. (Rus) Pochvovedenie. 12: 5-17. Ref. Dec. 1961. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 12: 1282-1291. Ref. Dec. 1961. 57.8 P34Ae

A regional classification was given for some reclaimed waterlogged soils in the non-Chernozem zone.

1181. Zaidel'man, F. R. WATER REGIME AND PHYSICAL PROPERTIES OF THE WATER-LOGGED BOTTOMLAND SOILS IN THE SOUTHERN PART OF TAIGA ZONE. (Rus) Pochvovedenie. 4: 5-19. Ref. Apr. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 4: 313-322. Ref. Apr. 1963. 57.8 P34Ae

A report was given on the water regime and physical properties of waterlogged and non-waterlogged soils in flood plains soils in the southern Taiga Zone of the U.S.S.R. for the design of drainage systems.

1182. Zaidel'man, F. R., and Ogleznev, A. K. GLEY FORMATION IN FLOOD PLAIN SOILS OF THE NON-CHERNOZEM ZONE. (Rus) Pochvovedenie. 1: 44-52. Jan. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 1: 30-37. Jan. 1963. 57.8 P34Ae

A report was given of the gley formation in bottomland soils of the non-Chernozem zone of the U.S.S.R.

1183. Zaidel'man, F. R., and Vinogradov, V. G. STUDIES OF THE MOISTURE REGIME AND PHYSICAL PROPERTIES OF WATERLOGGED FINE-TEXTURED SOD-PODZOLIC SOILS. (Rus) Pochvovedenie. 7: 80-93. Ref. July 1964. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 7: 723-733. Ref. July 1964. 57.8 P34Ae

A study was reported on the water regime and physical properties of waterlogged fine-textured sod-podzolic soils in the U.S.S.R.

1184. Zaitsev, A., Sigaev, E., and Kuz'mina, K. APPARATUS FOR THE DETERMINATION OF SOIL MOISTURE. (Rus) Kartofel'i Ovoshchi. 4: 57. Apr. 1964. 75.8 K147

1185. Zawadzki, S. INVESTIGATIONS OF THE ORIGIN AND EVOLUTION OF BOG SOILS RICH IN CALCIUM CARBONATE IN THE LUBLIN DISTRICT. (Po) Lublin. U. Marii Curie-Sklodowskiej. Ann. Sect. E 12(1): 1-86. maps. Ref. 1957, pub. 1959. 512 L96Ae
English summary.

A report was given on an investigation of peat bogs soils in Poland.

1186. Zinke, P. J. THE INFLUENCE OF A STAND OF *PINUS COULTERI* ON THE SOIL MOISTURE REGIME OF A LARGE SAN DIMAS LYSIMETER IN SOUTHERN CALIFORNIA. *In* International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge. 2: 126-138. 1959. 292.9 As7C

A report was given on the influence of a stand of *Pinus coulteri* on the soil moisture regime of a large San Dimas lysimeter in southern California.

1187. Zlatev, G. NOMOGRAPH AND COMPUTING APPLIANCE FOR DETERMINING THE PERCENTAGE OF MOISTURE IN THE SOIL BY GRAVIMETRIC METHOD. (Bu) Plovdiv. Inst. Tyutyuna. Izv. 3: 77-85. 1963. 69.9 P72
English summary.

A nomograph and computing appliance used in Bulgaria were described. They are used to help determine the moisture percentage of soils by the gravimetric system.

1188. Zonneveld, L. S. PHYSICAL RIPENING OF FRESHWATER-TIDAL SEDIMENTS. Cong. Internatl. de la Sci. du Sol. Rap. 6(B): 281-290. Ref. 1956. 56.09 In8452

A report was given of fundamental process of soil formation in alluvial and other water deposited sediments in the Netherlands. Physical ripening is the first stage of soil formation in water deposited sediments.

The loss of water is by dehydration of the soil colloids and decomposition of waterholding organic matter. Due to the high content of organic matter in the fresh-water-tidal-delta the shrinkage of normal clay loams is more than 50 percent.

SEE ALSO--64, 79, 208, 308, 324, 1200, 1212, 1213, 1219, 1234, 1244, 1249b, 1252-1254, 1261, 1263, 1299, 1306, 1307, 1310, 1316, 1321-1323, 1334, 1337, 1346, 1347, 1357, 1358, 1371, 1382, 1384, 1397, 1419, 1445, 1475, 1498, 1500, 1508-1517, 1519, 1520, 1524, 1537, 1541, 1547, 1551, 1554, 1556, 1561, 1565, 1569, 1570, 1573, 1575, 1577, 1579, 1581, 1584, 1597, 1626, 1631, 1632, 1639, 1649, 1650, 1652, 1661, 1663, 1666-1670, 1677, 1693, 1694, 1720, 1742, 1751, 1753, 1758, 1766, 1769, 1781, 1784, 1792, 1796, 1798-1800, 1811, 1812, 1815, 1816, 1818-1820, 1823, 1827, 1831-1833, 1840, 1841, 1844, 1854, 1861, 1863, 1864, 1869-1871, 1881, 1893, 1895, 1903, 1904, 1914, 1917, 1921, 1922, 1924-1926, 1934, 1937, 1940, 1946, 1947, 1958, 1959, 1968, 1971, 1994-1996, 1999, 2001, 2030, 2050, 2052, 2055, 2062, 2074, 2085, 2099, 2110, 2117,2118, 2121, 2131, 2133, 2134, 2141, 2144, 2161, 2168, 2173, 2176, 2179, 2180, 2182, 2188, 2191, 2198, 2207, 2213, 2216, 2218, 2223, 2224, 2233, 2236, 2246, 2255, 2256, 2259, 2272, 2279, 2281-2284, 2288, 2291, 2293, 2295, 2297-2299, 2301, 2302, 2305, 2317, 2319, 2320, 2325, 2327, 2328, 2333, 2341, 2345, 2346, 2351, 2353, 2357, 2363, 2365, 2369, 2377, 2389, 2393, 2397, 2401-2403, 2408-2410, 2427, 2428, 2431, 2434, 2436, 2439-2442, 2446, 2447, 2452, 2453, 2455, 2456, 2463, 2467, 2468, 2475, 2486, 2489, 2490, 2493, 2505, 2509, 2511, 2512, 2515, 2524, 2527, 2530, 2533, 2535, 2536, 2538, 2546, 2547, 2554, 2556, 2557, 2561, 2573, 2574, 2576, 2577, 2588, 2592, 2594, 2596, 2597, 2599, 2603, 2609, 2610, 2624, 2628, 2632, 2633, 2642, 2644, 2646, 2647, 2649, 2650, 2662-2664, 2666, 2667, 2669, 2677, 2678, 2680, 2681, 2683, 2695, 2701, 2706, 2709, 2712, 2716, 2721-2724, 2726, 2727, 2735, 2736, 2738, 2744, 2750, 2758, 2761, 2764, 2769, 2775, 2784, 2788, 2796, 2804, 2806, 2808, 2810, 2814, 2815, 2821, 2822, 2824, 2825, 2835, 2843, 2845-2847, 2849, 2852, 2854, 2859, 2861, 2864, 2867, 2868, 2871, 2873-2875, 2878, 2879, 2881, 2883, 2893, 2895, 2896, 2898, 2901-2908, 2910, 2914, 2917, 2918, 2920-2922, 2924, 2928-2930, 2932, 2939, 2940, 2948, 2953, 2954, 2957, 2959, 2961-2966, 2974-2977, 2979, 2980, 2983, 2984-2986, 2990, 3018, 3069, 3085, 3092, 3093, 3099, 3100-3112, 3146, 3191, 3203, 3211-3213, 3225, 3229, 3233, 3234, 3247, 3254, 3255, 3287, 3295, 3296, 3303, 3308, 3333, 3351, 3383, 3390, 3403, 3412, 3413, 3415, 3427, 3430, 3450, 3465, 3474, 3478, 3482, 3483, 3496, 3514, 3547, 3581, 3582, 3584-3586, 3589-3592, 3594, 3597, 3598,3602-3604, 3606-3612, 3615, 3617-3620, 3624-3627, 3630-3632, 3637-3639, 3642-3645, 3647, 3653, 3655-3657, 3659-3661, 3664, 3665, 3668-3670, 3673-3676, 3678-3681, 3683, 3684, 3686-3688, 3692-3695, 3697, 3700-3703, 3708, 3709, 3711, 3713, 3715-3717, 3721-3723, 3725-3727, 3730, 3731, 3733, 3736, 3737, 3739, 3745, 3748, 3750-3752, 3754, 3762-3764, 3766, 3767, 3769, 3773, 3775, 3777, 3778, 3780, 3783, 3784, 3790, 3796, 3800, 3802-3808, 3810, 3816, 3817, 3819, 3821, 3823-3832, 3835, 3837, 3842-3845, 3850, 3853, 3856, 3858-3860, 3863, 3866, 3868-3871, 3874, 3875, 3878, 3880, 3882-3884, 3886, 3889, 3895, 3900, 3902-3904, 3906, 3907, 3910, 3912, 3916, 3917-3919, 3921, 3925, 3931-3934, 3936-3939, 3943, 3946-3948, 3952, 3955, 3958-3962, 3966, 3967, 3969, 3970, 3972-3974, 3976-3979, 3982, 3983, 3990-3992, 3994, 3995, 3998-4001, 4005-4010, 4013-4015, 4017, 4018, 4021, 4022, 4024, 4027, 4029-4031, 4035-4039, 4042, 4045, 4046, 4048, 4049, 4052, 4055, 4056, 4057-4059, 4063, 4066, 4069, 4073, 4074, 4077-4079, 4081, 4086, 4093, 4100, 4282, 4425, 4426, 4589, 4597, 4598, 4604, 4605, 4614, 4668, 4698, 4727-4730, 4777, 4779, 4852, 4857, 4876, 4880, 4888, 4896, 4934, 4958, 5084, 5099.

1189. Ackers, P. EXPERIMENTS ON SMALL STREAMS IN ALLUVIUM. J. Hydraul. Div., ASCE 90(HY 4): 1-37. 1964. 290.9 Am3Ps

An experimental study of small streams in alluvium indicated correlations between stream geometry and discharge. These were compared with established regime equations, with some areas of disagreement. Results were analyzed on the basis of sediment transport, channel roughness, and width-depth ratio. These three physical relationships could be used to predict the geometrical functions.

1190. Agasieva, S. I., and Barekyan, A. S. STABILITY AND CAPACITY OF THE BEDS OF WATER-INTAKE STREAMS. (Rus) Moscow. Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy. 37: 18-36. Ref. 1962. 292.9 M85

1191. Akademiia Nauk. INVESTIGATIONS OF CANAL DEFORMATIONS AND OF THE EFFECT OF IRRIGATION ON GROUND WATER IN AMUR-DARYA DOWNSTREAMS. (Rus) Moskva, Akademiia Nauk SSSR, 1956. 221 pp. Ref. (Aralo-Kaspiiskaia Kompleksnaia Ekspeditsiia. Vyp. 7) 1956. 55 Ak131

1192. Allis, J. A., Dragoun, F. J., and Sharp, A. L. TRANSMISSION LOSSES OF LOESSIAL WATERSHEDS. Trans. ASAE 7(3): 209-212, 217. 1964. 290.9 Am3Ps

It was concluded that valley transmission losses of precipitation excess developed on watersheds of about 1 to 8 square miles can be sufficiently large that they may significantly reduce outflow floods from such watersheds. Reductions ranged from 5 to 10 percent on small watersheds up to 30 percent on some larger watersheds.

1193. Alverson, K. FLOOD-PROOFING PAYS OFF FOR INDIANA FARMERS AND THEIR TOWNS. Soil Conserv. 29(9): 201-203. 1964. 1.6 So3S

A report was given on the value of the watershed development in the Elk Creek Watershed in Indiana.

1194. Anderson, D. J. WATERSHED PROJECT PROTECTS MONTANA CITY AGAINST FLOODS. Soil Conserv. 29(1): 251. 1964. 1.6 So3S

A report was given on the advantage of a watershed project in Montana to protect Montana City against floods.

1195. Anderson, H. W. WATER MANAGEMENT FORESTRY—A MODEL APPROACH. World Forestry Cong. Proc. 5(3): 1734-1738. 1962. 99.0 C76912A

Forest management for water yield and water control can be guided by the results of analyses using regression equations as models. When these models include physical expressions of the forest rationally related to the water product, it is possible to predict the effect of changes in forest conditions, to design forest conditions, and to estimate their effectiveness. Alternative methods in management may be substituted into an appropriate regression model, expressing the effects of forest condition on total water yield, floods, and sedimantation. From the results, an acceptable or optimum combination of forest management can be selected.

1196. Anderson, H. W., and Hobba, R. L. FORESTS AND FLOODS IN THE NORTHWESTERN UNITED STATES. Internatl. Assoc. Sci. Hydrol., pp. 30-38. 1959. 292.9 As7C

Past floods from 75 watersheds in western Oregon and Washington were analyzed using graphical, multiple regression, and covariance analyses and the results summarized as follows: (1) In Northwestern United States clear cutting of forests and forest fires have increased floods from watersheds for both rain-snowmelt floods and snowmelt floods; (2) where stocking of the forest has recovered with time in a watershed, the flood peak discharges have again decreased; (3) for watersheds with geology of marine sediments and for those with volcanic rocks the forest effects on floods were the same; (4) for great storms and small storms the effects of forest cutting on floods were the same; and (5) for rain-snow floods, forest effects on floods were greatest in the zone below the snowmelt line in a given storm and watershed.

1197. Anderson, R. S. MULTIPLE BENEFITS ON THE SHAKOPEE. Soil Conserv. 26(9): 206-207. Apr. 1961. 1.6 So3S

A report was given on the benefits of the Shakopee watershed in Minnesota for flood prevention, erosion control, reduced sediment, and wildlife production.

1198. Andreae, H. THE REGULATION OF THE RIVER SPREE AND ITS CONSEQUENCES FOR THE SOIL CULTIVATION ON THE OUTSKIRTS OF THE SPREEWALD DISTRICT. (Ge) Humboldt U. Wiss. Z. 7(3): 377-384. Ref. 1957-58. 509 B453
English summary.
Includes drainage and soil reclamation.

A report was given the effects of the River Spree on soil cultivation in an area in Germany. The deepening of the river lowered the water table and most of the arable land became coniferous forest or fallow. In order to reestablish soil cultivation, it was recommended to: Plow up the forest; use pump drainage systems; dam up the river and use irrigation for the crops.

1199. Archer, S. FLOOD PROBLEMS ON FLORIDA FLATLANDS. Soil Conserv. 26(9): 201-203. Apr. 1961. 1.6 So3S

A report was given on the effect of the 15.5 inches of rain by Hurricane Florence on two adjoining watersheds in Florida.

1200. Astapov, S. V., Emel'ianov, V. A., and Shishkov, K. N. APPLICATION OF RADIOACTIVE ISOTOPES OF COBALT AND IODINE IN RECLAMATION INVESTIGATIONS. (Rus) Gidrotekh. i Melior. 10(2): 22-29. Feb. 1957. 290.8 G362

1201. Baden, W., and Eggelsmann, R. WATER CIRCULATION OF A NORTHWEST GERMAN HIGH MOOR; A HYDROLOGICAL STUDY ON THE INFLUENCE OF DRAINAGE AND CULTIVATION ON THE WATER ECONOMY OF KONIGSMOOR, TOSTEDT/HAN. (Ge) Schrreihe. des Kuratoriums f. Kultbauw. 12, 156 pp. Ref. 1964. 18 Sch73
English summary.

A report was given on a hydrology study of a raised peat bog in Northwest Germany.

1202. Bailey, R. W., and Copeland, O. L. VEGETATION AND ENGINEERING STRUCTURES IN FLOOD AND EROSION CONTROL. Cong. Internatl. Union Forest Res. Organ., Vienna, Austria. 13: 1-23. Sept. 10-17, 1961. A292 F763V

Flood and erosion phenomena with special emphasis on their causes and control were discussed for the Intermountain region of the Western United States. The concepts and principles used in the analysis of flood and erosion problems and in the formulation of control programs in this area are basic to any program of erosion and flood control in which vegetation—forest or other—is to play an important part.

Vegetation was emphasized as the most efficient natural means of maintaining or restoring the norm of watershed hydrology and soil stability where it is determined that mismanagement of the lands or inadequate protection has resulted in accelerated flood occurrence and soil erosion.

In reestablishing the hydrologic norm of a watershed, revegetation and land management alone are often not enough to do the job but must be supplemented by engineering structures.

1203. Bailey, R. W., and Copeland, O. L. VEGETATION AND ENGINEERING STRUCTURES IN FLOOD AND EROSION CONTROL. Ogden, Utah, Intermountain Forest and Range Expt. Sta., 23 pp. Ref. 1961. A292 F763V

A report was given on the value of contour trenches and vegetation on flood and erosion control in the Western United States.

1204. Barnes, C., and Giefer, G. J., comp. INDEX TO PERIODICAL LITERATURE ON ASPECTS OF WATER IN CALIFORNIA. Calif. U. Water Resources Cent. Arch., Arch. Ser. Rpt. 14, 337 pp. May 1963. 292.9 C128

An index was given of references to questions on California water problems and development.

1205. Batel, G., Nicoli, A., and Chiche, S. PROTECTION OF THE IMPROVEMENT—AREAS AGAINST THE FLOODS OF THE SURROUNDING SMALL RIVER-BASINS IN TUNISIA. (Fr) Cong. Irrig. and Drain. Trans., Cong. 5(6): C4.53-C4.62. 1963. 55.9 C7652

A report was given of the improvements necessary in Tunisia to protect drainage ditches and canals during flood periods.

1206. Bay, R. R., and Klawitter, R. A. WHAT'S NEW IN WETLAND HYDROLOGY. Soc. Amer. Foresters. Proc. 1963: 175-177. 1964. 99.9 So13

A report was given on the research results of wetland hydrology studies in forested areas in the Lake States and the Southeastern United States.

1207. Beach, D. B. COLORADO SMALL-WATERSHED DAMS STOP FLOODS—BRING RECREATION. Soil Conserv. 29(9): 215-216. 1964. 1.6 So3S

A report was given on the value of small watershed dams to stop floods and to furnish recreation for the area in Colorado.

1208. Bear, J., and Dagan, G. MOVING INTERFACE IN COASTAL AQUIFERS. J. Hydraul. Div., ASCE 90(HY 4): 193-216. 1964. 290.9 Am3Ps

The movement of the interface between fresh water and sea water in coastal aquifers caused by changes in seaward flow of fresh water was considered. Approximate solutions to the moving interface, its shape, position, and velocity of displacement were suggested.

Assuming that the aquifer was relatively thin, the Dupuit assumption was applied to the flows in both the fresh water region above the interface and the salt water region below it. The average specific discharges obtained in this way were then combined with the continuity equation to yield partial differential equations for the time-variable thickness of the fresh water flow region.

The solutions derived were compared with experimental results obtained from a Hele Shaw model. Graphs and numerical examples were presented. The approximate solutions described the interface movement with sufficient accuracy for practical purposes.

1209. Beard, L. R. FLOOD CONTROL OPERATION OF RESERVOIRS. J. Hydraul. Div., ASCE 89(HY 1): 1-23. Jan. 1963. 290.9 Am3Ps

Dependable flood control operation of multi-purpose reservoirs requires the formulation and strict observance of a set of operating rules designed to provide essential flood control while assuring essential conservation accomplishments. In the Central Valley of California, fully satisfactory protection against unpredictable rain floods requires firm flood control space throughout the rainy season, with varying space requirements at the beginning and end of the season. Where conservation functions warrant, rain space requirement may be governed in part by ground conditions. Protection against snowmelt floods usually can be provided on a forecast basis, with good utilization of the flood control space for conservation purposes. Ungated spillways usually provide an important moderating effect on excessive floods, whereas gated spillways usually do not and must be operated with great care in accordance with prearranged schedules.

1210. Beard, L. R. FLOOD CONTROL OPERATION OF RESERVOIRS. Amer. Soc. Civil Engin. Trans. 129: 623-625. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure, of a study of flood control operations of reservoirs. The original article was published in J. Hydraul. Div., ASAE 89(HY 1): 1-24, Jan., 1963. The references to the discussions and closure were listed.

1211. Benson, M. A. CHANNEL-SLOPE FACTOR IN FLOOD-FREQUENCY ANALYSIS. J. Hydraul. Div., ASCE 85(HY 4): 1-7. Apr. 1959. 290.9 Am3Ps

Annual flood peaks in New England have been related to many hydrologic factors. The main-channel slope has been found next in importance to drainage-area size. The slope for that part of the main channel between 85 and 10 percent of the total distance above the gaging point provides the best correlation with flood magnitudes.

1212. Benz, L. C., Mickelson, R. H., Sandoval, F. M., and Carlson, C. W. GROUND-WATER INVESTIGATIONS IN A SALINE AREA OF THE RED RIVER VALLEY, NORTH DAKOTA. J. Geophys. Res. 66(8): 2435-2443. Ref. Aug. 1961. 470 J823

Investigations in a saline area of the Red River Valley in North Dakota indicated that salt-affected soils are caused by high water tables, poor drainage conditions, and saline artesian waters. A 3-year study conducted in a 200-square-mile area showed that rainfall was a major contributor to the high and fluctuating water table. Chemical composition of the ground waters indicated that the Dakota sandstone artesian waters were the most likely source of salt.

1213. Benz, L. C., Sandoval, F. M., Mickelson, R. H., and George, E. J. MICRORELIEF INFLUENCES IN A SALINE AREA OF ANCIENT GLACIAL LAKE AGASSIZ. II. ON SHALLOW GROUND WATER. Soil Sci. Soc. Amer. Proc. 28(4): 567-570. July/Aug. 1964. 56.9 So3

A study was made of the shallow ground water regime in a ridge-depression microrelief area where high salinity occurred in the ridges compared to low salinity in the depressions. Ground water movement was affected by: (1) Surface relief, which caused impounding of precipitation in the depressions; (2) greater hydraulic conductivities in the depressions; and (3) differences in moisture use due to greater tree and vegetative growth in the depressions. Water tables fluctuated from above the ground surface to depths of 10 feet. Salt concentrations of ground water were much higher in the ridges than the depressions. These differences occurred to a depth of 20 feet.

1214. Berg, K. WATER MANAGEMENT IN THE RHINE-MAIN REGION. (Ge) Mitt. der Deut. Landwirt.-Gesell. 74(17): 500-504. map. Apr. 23, 1959. 18 N39

1215. Berry, J. L. SAMPLING, CODING, AND STORING FLOOD PLAIN DATA. U.S. Dept. Agr., Econ. Res. Serv. Agr. Hbk. 237, 27 pp. 1962. 1 Ag84Ah

Practical methods of sampling, coding, and storing data relating to the agricultural occupancy of flood plains in the United States were reported.

1216. Bittinger, M. W. COLORADO'S GROUND-WATER PROBLEMS: GROUND-WATER IN COLORADO. Colo. Agr. Expt. Sta. B. 504-S, 28 pp. Aug. 1959. 100 C71S

A discussion was given of ground water problems (including drainage problems) in Colorado.

1217. Bittinger, M. W. GROUND WATER MANAGEMENT VITAL TO COMPREHENSIVE DEVELOPMENT OF RIVER BASIN WATER RESOURCES. Colo. Farm and Home Res. 12(4): 3-5, 7. 1962. 100 C712Co

Planned management and operation of ground water reservoirs in conjunction with surface-water supplies probably should include: (1) Heavy reliance upon ground water during years of deficient runoff. (2) Artificial recharge facilities to replace pumped ground water during years of favorable runoff. (3) Planned long-term storage in ground water aquifers where geologic conditions make it possible. This may involve transfer of water from surface reservoirs to underground reservoirs during fall and winter months to provide catchment capacity in the spring. And (4) because of the storage manipulations, the ground water reservoirs cannot be kept full and thus will not always provide return flow to the rivers. Many ditches may have to be served by pumps when surface water is not available.

1218. Black, P. E. TIMBER AND WATER RESOURCE MANAGEMENT. Forest Sci. 9: 137-145. 1963. 99.8 F7632

A graphical and mathematical procedure for predicting stream yield increases due to forest cutting was developed. Inventory data on streamflow and timber stands on the headwaters of the Fraser River, which supplies water to Denver, Colo., were used in the analysis. The authors concluded that the management intensity indicated by the analysis for the watershed was both realistic and desirable; and that the use of minimum figures throughout the analysis enhanced its practical value in application to the land through good land management practices.

1219. Blidaru, V. INSTALLATION FOR MEASUREMENT AND DISTANCE TRANSMISSION OF THE VARIATION OF SURFACE AND UNDERGROUND WATER LEVEL (RIVER, LAKE, ETC.). (Rum) Jassy. Inst. Agron. "Ion Ionescu de la Brad." Lucrari Sti. 1961: 421-428. 106.4 J31L
French summary.

1220. Bliznyak, E. V., and Rossinskii, K. I. BASIC METHODS FOR COMPUTING CHANNEL PROCESSES IN RIVERS CAUSED BY ARTIFICAL MODIFICATION OF THE RIVER REGIME. In PROBLEMS OF RIVER RUN-OFF CONTROL. (Translated from Russian) OTS 61-11431 6: 1-74. 1961. 290.9 AK1Ae

Basic methods were given for computing channel processes in rivers caused by modification of the river regime in the U.S.S.R.

1221. Bodhaine, G. L. FLOOD-FREQUENCY RELATIONSHIPS IN THE PACIFIC NORTHWEST. J. Hydraul. Div., ASCE 86(HY 9): 1-10. 1960. 290.9 Am3Ps

A method was presented for determining the magnitude and frequency of floods to be expected at any site in the Pacific Northwest. Flood-frequency curves for individual stations were combined into several regional flood-frequency curves. The regions include stations for which slopes of individual flood-frequency curves were similar. The regional curves show flood magnitudes in terms of mean annual floods. To obtain the frequency curve for an ungaged site, it is only necessary to compute the mean annual flood for that site and convert the appropriate regional frequency curve to flow in cubic feet per second by multiplying the ordinates of that curve by the mean annual flood.

1222. Bodhaine, G. L. FLOOD-FREQUENCY RELATIONSHIPS IN THE PACIFIC NORTHWEST. Amer. Soc. Civil Engin. Trans. 126(1): 1858-1867. 1961. 290.9 Am3

A method was described of determining the magnitude and frequency of expected floods that is applicable to any area in the Pacific Northwest of the United States. The development of a composite frequency curve applicable to any site in a large homogeneous region was examined, and the effect of mean elevation and size of drainage area on the shape of the frequency curves in designated parts of the Pacific Northwest was demonstrated. A formula for determining the mean annual flood for any site on the west side of the Cascade Range in Washington was shown, and the drainage-basin characteristics used in its derivation were listed. A flood-frequency curbe can be drawn for any given site in the Pacific Northwest by combining the results obtained from the mean annual flood formula and the composite frequency curve that are both applicable to that site.

1223. Bornstein, J. DESIGN OF A FLOOD-RETARDING STRUCTURE. Agr. Engin. 37(9): 609 and 617. Sept. 1956. 58.8 Ag83

The design of a flood detention dam and outlets, the procedure necessary for approval, and legal authorization for construction for the northeastern part of the United States were discussed.

1224. Bouwer, H. RESISTANCE NETWORK ANALOGS FOR SOLVING GROUND-WATER PROBLEMS. Ground Water. 2(3): 26-32. July 1964.

A report was given on the use of resistance network analogs for solving ground water problems.

1225. Brakensiek, D. L. FITTING A GENERALIZED LOG-NORMAL DISTRIBUTION TO HYDROLOGIC DATA. Amer. Geophys. Union Trans. 39: 469-473. 1958. 330.9 Am3

A statistical distribution was developed which makes it possible to fit a wide range of positively skewed hydrologic data. It was shown that the general least-squares fitting equations will reduce to simple forms for fitting a normal, log-normal or extreme-value distribution to data. Two fitting processes were developed for fitting data by the so-called generalized log-normal distributions. Examples were given for illustrating the fitting procedures.

1226. Brakensiek, D. L. ESTIMATING DEPENDABLE ANNUAL STREAMFLOW IN THE UNGLACIATED ALLEGHENY PLATEAU. U.S. Dept. Agr., Agr. Res. Serv., ARS 41-56, 34 pp. 1961. A56.9 R31

A procedure was presented for estimating annual streamflow for any level of dependability. The study was limited to the unglaciated Allegheny Plateau area. The data were worked on an annual streamflow amounts, in units of inches over the watershed for watersheds ranging in size from under 100 acres to 400 square miles.

Watershed information for the area was presented in table form and mean annual precipitation maps were presented for the States in the area.

A series of graphs were presented showing the fit of the normal distribution to annual runoff data for various locations in the area.

1227. Brakensiek, D. L. ESTIMATING COEFFICIENTS FOR STORAGE FLOOD ROUTING. J. Geophys. Res. 68: 6471-6474. 1963. 470 J823

Storage flood routing is a method for predicting flood wave propagation in a stream. It is based primarily on the equation of continuity. Flow at a section is assumed to be a single-valued function of the flow area. Additional assumptions are used to develop a linear relationship between reach storage and reach inflow and outflow. The relationship defines two coefficients which correspond to the X and K of the Muskingum formulation for reach storage. Several estimating procedures were developed as a consequence of the derived relationships.

1228. Brown, C. B. ECONOMICS AND FINANCING OF IRRIGATION, DRAINAGE AND FLOOD CONTROL WORKS. Cong. Irrig. and Drain. Trans. 5(3): R.15.281-R.15.294. 1963. 55.9 C7652

A report was given of economics and financing of irrigation, drainage, and flood control works in the United States under the Watershed Protection and Flood Prevention Act. This Act authorizes the Department of Agriculture to give technical and financial assistance to local organizations in planning and carrying out projects for water and related land resource protection and development in watersheds of not more than 250,000 acres. Federal assistance is provided only where benefits exceed costs.

1229. Brown, C. B. ROLE OF SMALL WATERSHEDS IN RIVER BASIN PLANNING. J. Soil and Water Conserv. 18: 14-18. 1963. 56.8 J822

The role of small watersheds in river basin planning is rapidly becoming a significant national issue. The development of the conflict between the philosophy that calls for monumental dams on the main rivers to control water and the philosophy that runoff should be controlled where it originates in the headwaters was traced. Practical guidelines for river basin planning were given.

1230. Bulakh, V. L., Solomentsev, N. A., and Chekmarev, V. A. PRINCIPLES OF HYDROLOGY AND AGRICULTURAL MELIORATIONS. (Rus) Leningrad, Gimiz, 1955. 311 pp. Ref. 1955. 292 B872

1231. Bull, W. B. HISTORY AND CAUSES OF CHANNEL TRENCHING IN WESTERN FRESNO COUNTY, CALIFORNIA. Amer. J. Sci. 262: 249-258. 1964. 470 Am34

Most of the recent channel trenching in western Fresno County, Calif., has occurred since 1855. Reports of early settlers, maps, and field evidence indicate two periods of accelerated erosion, one from 1875-95 and the other from about 1935-45.

Many channels were deepened a total of 25 to 40 feet. During the period of erosion that started about 1935, many streams cut deeper, leaving the previous channel bottoms as terraces.

1232. Bullock, A. E. TAMING THE PIT RIVER. Soil Conserv. 26(9): 210-211. Apr. 1961. 1.6 So3

A report was given on the use of levees and channel straightening to tame the Pit River in California.

1233. Burford, J. B., and Lillard, J. H. HIGH ACCURACY STREAMFLOW MEASUREMENT WITH LOW-COST INSTALLATIONS. Trans. ASAE 6(4): 276-278, 281. 1963. 290.9 Am32T

Existing rateable structures such as highway box-type culverts and other flow-control devices are prevalent in many areas where the need for small watershed hydrologic data is most acute. Where supplemented by proper low-flow controls, these structures can be instrumented to form accurate and reliable streamgaging stations.

The Virginia V-notch weir, properly designed and located with respect to the existing structure, constitutes a very economical and efficient low-flow control in such an installation.

More than 51 watershed years of records from the Virginia stations have demonstrated the splendid performance of these low-cost gaging stations, both from the standpoint of reliability of records and low maintenance costs.

1234. Buttlar, H. von. GROUND-WATER STUDIES IN NEW MEXICO USING TRITUIM AS A TRACER, II. J. Geophysical Res. 64(8): 1031-1038. Ref. Aug. 1959. 470 J823

The monitoring of the tritium concentration of rain-water and ground-water samples in New Mexico has been continued. A third peak in the rain water was found in the summer of 1957. By comparison of the tritium content of a ground-water sample with that of the rain water, hydrologic quantities such as the age and velocity of flow of the ground water could be determined. The tritium method shows consiserable promise as a hydrologic tool.

1235. Caldart, F. LESSONS OF EXPERIENCE IN FOREST HYDRAULIC REGULATION. (It) Monti e Boschi. 12(3): 111-117. Mar. 1961. 16 M76
English summary.

In Italy, in the autumn of 1960, it was learned that in the mountain basin area, soil drainage intergrated by supplementary stoneworks in the riverbeds were needed to stop soil erosion and flood drainage.

1236. Caponi, U. HEAVEN HELPS THOSE WHO HELP THEMSELVES! (It) Nuova Agr. Lucana. 5(9): 129-133. Sept. 1957. 16 N923

1237. Carter, R. W., and Anderson, I. E. ACCURACY OF CURRENT METER MEASUREMENTS. J. Hydraul. Div. ASCE 89(HY 4): 105-115. July 1963. 290.9 Am3Ps

The probable accuracy of a stream-flow measurement made by the current-meter method at a gaging site that was selected at random was evaluated. Standard deviation of discharge-measurement errors in percent of mean was determined from the variance of the partial errors. Variances of the partial errors resulting from the current meter, by velocity fluctuations, by the shape of the vertical velocity curve, and by the number of observation stations in the section were defined by special measurements on many different streams. The information can be used to determine the observation procedure necessary to obtain a given accuracy of measurement.

1238. Chambers, C. C. CONSERVANCY DISTRICTS AS FLOOD CONTROL ORGANIZATIONS. J. Hydraul. Div., ASCE 86(HY 4): 1-9. Apr. 1960. 290.9 Am 3Ps

A well designed conservancy district is a valuable organization for developing, constructing, and administering a comprehensive water management program for an intrastate watershed.

The evidence indicated that this type organization is well adapted to the solution of flood problems, especially when approached on a drainage area basis. It was most applicable in the field that lies between those problems that can be solved best by existing local governmental agencies and the problems of the major rivers, which are interstate in character and in which a federal interest is predominant.

1239. Chatry, F. M. FLOOD DISTRIBUTION PROBLEMS BELOW OLD RIVER. J. Hydraul. Div., ASCE 86(HY 8): 1-15. Aug. 1960. 290.9 Am3Ps

The system described can be operated in a planned and predictable manner for peak total flows at the latitude of Old River up to and including 3,030,000 c.f.s., a value that has been established by extensive meteorological and hydrological studies as the largest likely to occur. With the exception of the West Atchafalya Floodway, which will operate less often than once every hundred years, the economic disruption deriving from system operation is not great. It varies from negligible in the case of an operation of Bonnet Carre Spillway to minor for a Morganza Floodway operation. And the overall system's flexibility and adaptability are such that the end of its useful life cannot now be foreseen. With the system operating, the threat of damaging overflow below Old River has been virtually eliminated.

1240. Chow, V. T., ed. HANDBOOK OF APPLIED HYDROLOGY, A COMPENDIUM OF WATER-RESOURCES TECHNOLOGY. New York, McGraw-Hill, 1964. various paging. map. Ref. 1964. 292 C45

A compendium was given of water resources technology. An attempt was made to obtain a comprehensive treatment covering various aspects of applied hydrology. A total of forty-five authors made contributions to the book.

1241. Chun, R. Y. D., Mitchell, L. R., and Mido, K. W. GROUND-WATER MANAGEMENT FOR THE NATION'S FUTURE—OPTIMUM CONJUNCTIVE OPERATION OF GROUND-WATER BASINS. J. Hydraul. Div., ASCE 90(HY 4): 79-95. 1964. 290.9 Am3Ps

A general purpose method to determine the most economical coordinated operation of surface and underground water supplies and facilities was developed. This method enables the engineer to integrate surface and ground water usage in operational and economic evaluation of alternative plans of operation, and allows determination of most economic combined use of facilities.

Written in general terms, and preserved in the computer program statements, the method also allows for rapid updating and adjustment of operating criteria as experience is gained in the actual operation of a selected plan. The cost and hydraulic information gained will provide management an insight for solution of the administrative and legal problems that may accompany any operational plan.

1242. Cline, C. E. FARMERS, CONTRACTORS TO SHARE BENEFITS OF DEEP CREEK PROJECT. Land and Water Conserv. 1(9): 6-8, 10. 1959.

Work was begun in August, 1959, on three floodwater retarding structures in the Deep Creek Watershed of Yadkin County, N.C. This marked the beginning of structural installation on the 75,300-acre watershed.

When the project is completed annual floodwater and sediment damage on the entire watershed is expected to be reduced from an average annual cost of $177,325 to about $48,517 a year. Additional benefits will be incurred in increased yields and better land utilization. Recreation, in the form of better hunting and fishing, will be a major benefit. Annual chores such as rebuilding fences, redigging ditches, and reworking crops damaged by floods will be eliminated.

1243. Coleman, N. L. OBSERVATIONS OF RESISTANCE COEFFICIENTS IN A NATURAL CHANNEL. Internatl. Assoc. Sci. Hydrol., Comm. Land Erosion. 59: 336-352. 1962.

Observations were made of the instantaneous Darcy-Weisbach resistance coefficients in a natural channel during short discrete periods of flow. The results show that the channel resistance coefficient changed considerably as a runoff event progressed. The shape of the time-resistance graph was apparently related to the intensity and duration of the flow.

1244. Commonwealth Bureau of Soils. TRITIUM IN GROUNDWATER AND AS GROUNDWATER TRACER (1964-1956). Commonwealth Bur. Soils [Annot. Bibliog.] 759, 3 pp. 1964. 241 C734A

An annotated bibliography was given of the use of tritium as a ground water tracer for the period 1956 to 1964.

1245. Conring, H. COASTAL PLAN, A COMMUNITY PROJECT. (Ge) Praxis u. Forsch. 8: 39-40. Mar. 27, 1956. 18 P89

1246. Court, A. MEASURES OF STREAMFLOW TIMING. J. Geophysical Res. 67: 4335-4339. 1962. 470 J823

Half-flow dates, defined as the dates on which half of the year's total streamflow has passed, appear to be useful measures of streamflow "timing". For studying possible changes in streamflow regime caused by watershed management practices, especially vegetational manipulation aimed at increasing snowpack and delaying snowmelt, half-flow dates seem to be more suitable than the date of momentary maximum flow. They are more sensitive to change in regime than another criterion in general use, the percentage of flow occurring during one or more fixed months.

1247. Craddock, G. W. FLOODS CONTROLLED ON DAVIS COUNTY WATERSHEDS. J. Forestry. 58: 291-293. 1960. 99.8 F768

Severe mountain born floods came to Davis County, Utah in 1923 and 1930. These floods were nothing like the gradual rise of streamflow to moderately high and readily handled discharges that occurred each spring during the snowmelt season. Instead, they came suddenly in midsummer as churning, barely fluid masses of mud, gravel, and rock. Some of the floods carried boulders weighing up to 100 tons.

The discharges spread out from canyon mouths to engulf homes, block highways, and bury farm lands under raw sediment up to 6 feet in depth. Several persons were killed. Flood damages exceeded $1 million, or nearly one-fifth of the assessed value of all property in that part of the country.

1248. Criddle, W. D. GROUND WATER PROBLEMS IN UTAH. Natl. Reclam. Assoc. Proc. 30: 109-111. 1961. 55.9 N212

A report was given on ground water problems in Utah. The biggest problem has been to maintain a balance while changing from flowing wells to pump wells.

1249a. Cross, W. P., and Webber, E. E. FLOODS IN OHIO: MAGNITUDE AND FREQUENCY. Ohio Dept. Natl. Resources, Div. Water B. 32, 323 pp. 1959. 292.9 Oh33

A report was given on the magnitude and frequency of floods in Ohio based on records through 1956.

1249b. Dahiphale, M. V. FLOOD CONTROL AND LAND RECLAMATION IN HOLLAND. Indian Farming. 5(12): 34-38. Mar. 1956. 22 In283

A report was given on flood control and land reclamation in the Netherlands. The use of open ditches and tile for drainage was stressed.

1250. Davis, I. F. COLORADO'S GROUND-WATER PROBLEMS: THE ECONOMIC PICTURE. Colo. Agr. Expt. Sta. B. 506-S, 32 pp. June 1960. 100 C71S

The economic aspects of ground water problems in Colorado were discussed.

1251. Davydov, A. RECLAMATION OF FLOOD LANDS IN OMSK REGION. (Rus) Sel'sk. Khoz. Sibiri. 1958(9): 87-91. Sept. 1958. 20 Se492

1252. Diamond, R. B., Hammond, L. C., and Myers, J. M. DRAINAGE CHARACTERISTICS OF LEON AND FELDA SANDS. I. WATER TABLE BEHAVIOR. Soil and Crop Sci. Soc. Fla. Proc. 21: 38-44. 1961, pub. 1962. 56.9 So32

A report was given on the influence of soil types, physical properties of the soil profile, and ditch spacings on the behavior of the water table during drainage and subirrigation on Leon and Felda sands in Florida.

1253. Dieleman, P. J., and Ridder, N. A. De. STUDIES OF SALT AND WATER MOVEMENT IN THE BOL GUINI POLDER, CHAD REPUBLIC. J. Hydrol. 1(4): 311-343. map. Ref. 1963. 292.8 J82

A report was given on hydrogeological investigations of Lake Chad in the Chad Republic of Africa, where the ground water flow from the lake was toward and into low-lying polders. The seepage flow was sufficient to balance the consumptive use of crops but the quality of the ground water threatened complete salinization of the polders.

1254. Dieleman, P. J., and Ridder, N. A. De. STUDIES OF SALT AND WATER MOVEMENT IN THE BOL GUINI POLDER, CHAD REPUBLIC. Internatl. Inst. Land Reclam. and Impr. B. 5, 40 pp. map. Ref. 1964. 54.9 In83B

A report was given on salt and water movement in the Bol Guini polder in the Chad Republic in Africa. The ground water flow is from the direction of the lake towards and into low-lying polders. The seepage flow is sufficient to balance the consumptive use of crops but the quality of the seepage water is such that the polders are threatened by complete salinization.

1255. Dijk, D. C., Van. WATER SEEPAGE IN RELATION TO SOIL LAYERING IN THE CANBERRA DISTRICT. Austral. Commonwealth Sci. and Indus. Res. Organ. Div., Soils Div. Rpt. 5, 9 pp. Sept. 1958. 56.9 Au7

Seepage conditions in and around Canberra, Australia were studied.

General suggestions for drainage measures for the area were given for the following three distinct forms of waterlogged conditions found: (1) Superficial hillslope drainage; (2) seepage of linear aquifers; and (3) seepage caused by ground water.

1256. Diskin, M. H. TEMPORARY FLOW MEASUREMENT IN SEWERS AND DRAINS. J. Hydraul. Div. ASCE 89(HY 4): 141-159. July 1963. 290.9 Am3Ps

Temporary flow measurement in circular channels, such as sewers and drains, as well as in sewers of other cross sections, can be carried out by introducing into the flow a pier-shaped element with a bottom rounded to fit the circular invert of the channel.

The device is, in effect, a critical depth flume, or a Venturi flume, with an irregularly shaped throat composed ot two openings on either side of the element introduced. Applying the theory of critical depth flumes, equations were derived relating the discharge to depth at the measuring section; the equations were solved numerically, making use of standard tables of properties of parts of a circle.

The results of experiments performed on the proposed measuring device indicated fairly close agreement between the measured and the calculated rates of flow, most values of the coefficient of discharge falling in the range of 0.90 to 1.00.

1257. Dixey, F. GEOLOGY AND GEOMORPHOLOGY, AND GROUNDWATER HYDROLOGY. United Nations Edu. Sci. and Cult. Organ. Arid Zone Res. 18: 23-52. Ref. 1962. 278.9 Un3

The effects of geology and geomorphology on ground water hydrology in arid regions were discussed.

1258. Doran, W. E. GREAT OUSE FLOOD PROTECTION SCHEME. Brit. Sugar Beet Rev. 27(2): 81-82, 84, 86. map. Dec. 1958. 66.8 B77

A report was given on the flood protection scheme used in Great Britian to protect the drained fens from occasional flooding.

1259. Edelman, C. H. ORIGIN OF THE MAN-MADE LANDSCAPE OF PERIODICALLY FLOODED AREAS. (Du) Boor en Spade. 8: 141-142. 1957. 56.9 B64
English summary.

The history of man-made landscapes of frequently flooded areas in the Netherlands was given.

1260. Eden, E. W., Jr. FLOODS OF THE FLORIDA EVERGLADES. J. Hydraul. Div., ASCE 85(HY 6): 43-65. June 1959. 290.9 Am3Ps

Large areas in central and southern Florida are subject to seasonal flooding, since the natural streams are inadequate to remove excess rainfall during wet seasons. Major floods of record in the Everglades and man's efforts to bring that area into productive use through flood and water control were discussed.

1261. Emel'ianov, V. A., and Shishkov, K. N. UTILIZATION OF CO^{60} AND J^{131} RADIOACTIVE ISOTOPES IN FIELD SOIL-MELIORATIVE INVESTIGATIONS. (Rus) Vsesoluzn. Nauch.-Tekh. Konf. po Primeneniiu Radioaktivnykh i Stabil'nykh Izotopov i Izluchenii v Narod. Khoz. i Nauke. Trudy: Fiziol. Rast. Agrokhem. Pochvoved. 1957: 333-340. Ref. 1958. 463.3 V962

1262. Engulatov, I. A., Eremenko, G. V., and Usmanov, A. ON CRITICAL DEPTH OF UNDERGROUND WATERS. (Rus) Gidrotekh i Melior. 7: 21-30. Ref. July 1964. 290.8 G362

1263. Eriksson, E. SURVEY OF THE TRACER TECHNIQUE AND ITS APPLICATION IN GROUNDWATER HYDROLOGY. (Sw) Grundforbattring. 17(2): 109-121. 1964. 54.8 G92

1264. Ernst, L. F., and Westerhof, J. J. THE DEVELOPMENT OF HYDROLOGICAL RESEARCH IN ITS APPLICATION IN THE DRAINAGE OF THE NETHERLANDS. (Fr) Internatl. Assoc. d'Hydrol. Sci. Symp. Darcy. 2: 148-164. Ref. 1956. 292.9 As7S

1265. Estes, H. N. A MULTI-PURPOSE DAM IN TENNESSEE FOR FLOOD PREVENTION AND FISH AND WILDLIFE DEVELOPMENT. Soil Conserv. 25: 247-248. 1960. 1.6 So3S

Floodwater retarding structure No. 4 in the Thompson Creek watershed will be the first such structure in Tennessee designed for both flood prevention and fish and wildlife benefits. It is the 34th such structure in the Nation built under provisions of Public Law 566, the Watershed Protection and Flood Prevention Act.

1266. Ferrell, W. R., Jr. MOUNTAIN CHANNEL TREATMENT IN LOS ANGELES COUNTY. J. Hydraul. Div., ASCE 85(HY 11): 11-19. Nov. 1959. 290.9 Am3Ps

The background and some of the details were given of a program of research and developments aimed at reducing the volume of debris that must be handled by the Flood Control District. The stabilization of the main channels of a watershed by mechanical means was the most practical method of accomplishing debris reduction. Mechanical stabilization by the use of check dams reduces erosion by halting channel downcutting and by reducing the occurrence of bank sloughing. Other benefits also provided were the new debris storage capacity behind each of the check dams and the conservation of water through direct storage and increased percolation opportunity. The Big Santa Anita Project, near Arcadia, represents the first full-scale use of this type of treatment in this area. The project, when completed, will stabilize 50,000 feet of main channel in this 11 square mile watershed. The project cost is estimated to be $1,750,000.

1267. Fishel, V. C. LONG-TERM TRENDS OF GROUNDWATER LEVELS IN THE UNITED STATES. Amer. Geophysical Union. Trans. 37: 429-435. Ref. Aug. 1956. 330.9 Am3

A report was given on the long-term trends of ground water level in the United States.

1268. Foley, J. COMPUTER APPLICATIONS IN GROUNDWATER HYDROLOGY. Amer. Soc. Civil Engin. Trans. 126(3): 159-175. 1961. 290.9 Am3

The Theis equation was adapted for computer solution of four types of problems inherent in many industrial well-water developments. These types were: (1) Drawdown computation; (2) aquifer constants "T" and "S"; (3) well spacing; and (4) capacity of a well system. Objectives, equations, computation sequence, print-out of results and computer time were outlined for each problem.

1269. Ford, E. C., Cowan, W. L., and Holtan, H. N. FLOODS—AND A PROGRAM TO ALLEVIATE THEM. U.S. Dept. Agr., Agr. Ybk. 1955: 171-176. 1955. 1 Ag84Y

The problems of floods has grown as we have contested Nature's delegation of certain lands to floodways, and have settled along streams, put utilities on the streambanks, and established farms over adjacent areas. There is need for an interrelated threefold program, each part of which would be given proper weight in terms of public assistance and would be coordinated with the others to the fullest degree possible. These are: (1) Land treatment; (2) upstream waterflow retardation and channel stabilization; and (3) downstream flood-control measures.

1270. Fowler, L. C. GROUND-WATER MANAGEMENT FOR THE NATION'S FUTURE—GROUND-WATER BASIN OPERATION. J. Hydraul. Div., ASCE 90(HY 4): 51-57. 1964. 290.9 Am3Ps

Total usable water supply can be increased by coordinated operation of surface and underground water resources. Under optimum coordinated operation, the unit cost of water supply storage and distribution can be a minimum. Efficiency in managing ground water basins to bring about coordinated operation requires new concepts to be evolved and to be effectively applied.
The basic principles of ground water basin operation that will result in an optimum water resources management scheme for an area were summarized.

1271. Fujisaki, M. THE PROCESS OF RESTORATION IN THE FLOODED DISTRICT OF SAGA PREFECTURE. II. (Ja) Kyushu Agr. Res. 16: 154. Oct. 1955. 107.6 K996

1272. Garde, R. J., and Raju, K. G. R. REGIME CRITERIA FOR ALLUVIAL STREAMS. J. Hydraul. Div., ASCE 89(HY 6): 153-164. Nov. 1963. 290.9 Am3Ps

Several criteria were proposed, prior to 1963, to predict the nature of the bed and water surfaces of an alluvial stream under different conditions. Most of these criteria have been based mainly on flume data and used the shear stress as the chief parameter. This investigation revealed that these criteria do not predict the regimes of flow accurately enough for natural streams, as compared with those in flumes. Hence, instead of using the shear stress, a new criterion, using the individual values of hydraulic radius and slope, was presented. It was based on all the available data for flumes and natural streams. This criterion can be used for prediction regimes, in problems involving resistance to flow, as well as sediment transport.

1273. Gerabek, K. TEN YEARS OF AGRICULTURAL HYDROLOGY IN AUSTRIA. Oesterr. Wasserwirt. 8(3): 46-48. Mar. 1956. 55.8 Oe8

1274. Getty, H. C., and McHughs, J. H. SYNTHETIC PEAK DISCHARGES FOR DESIGN CRITERIA. J. Hydraul. Div., ASCE 88(HY 5): 1-12. Sept. 1962. 290.9 Am3Ps

A method was presented for determining peak discharges at stations where records are too short to afford reliable data or at ungaged locations. The method was based on the two principal factors that create peak discharges: (1) The volume of surface runoff; and (2) the distribution of surface runoff. The data presented were compiled specifically for the hill areas of Arkansas and Missouri. The data are useful in determining discharges at bridges, culverts, dams, and other hydraulic structures, and for flood damage investigations.

1275. Grant, Z. C. OPERATION AND MAINTENANCE OF THE COMPLETED WORKS OF THE EVERGLADES AGRICULTURAL AREA. Soil and Crop Sci. Soc. Fla. Proc. 20: 282-293. maps. 1960. 56.9 So32

A discussion was given on the operation and management of the completed works of the Everglades Agricultural Area for flood control and drainage.

1276. Gray, D. M. DERIVATION OF HYDROGRAPHS FOR SMALL WATERSHEDS FROM MEASURABLE PHYSICAL CHARACTERISTICS. Iowa Agr. and Home Econ. Expt. Sta. Res. B. 560: 517-570. 1962. 100 Io9

The development of a method for synthesizing the unit hydrograph for small watetsheds from topographic characteristic was studied. The topographic and hydrologic characteristics from 42 watersheds located in Illinois, Iowa, Missouri, Nebraska, Ohio, and Wisconsin were investigated. These watersheds varied in size from 0.23 to 33.00 square miles.

Five watershed characteristics were measured on each basin: drainage area size, A; length of the main stream, L; length to the center of area, L_{ca}; slope of the main stream, S_c; and mean land slope, S_L. An initial attempt to relate these factors with hydrograph properties by employing the principles of dimensional analysis proved unsuccessful.

1277. Grimes, M. GOVERNMENT AND NATURAL RESOURCES IN KANSAS: WATER. Kansas U. Govt. Res. Cent. Lawrence, Kans. 87 pp. 1957. 292 K136

A report was given on the governmental programs that affect water in Kansas.

Several units of local government in Kansas are authorized to engage in drainage and flood control activities. Counties, townships, cities, levee districts, drainage districts, watershed districts, and soil conservation districts all have statutory authority to take steps to control the drainage of waters within the boundries of the unit and to protect their respective areas from overflow. The role of the national government programs was also explained.

1278. Hall, W. A. PERCHED WATER TABLES UNDER AN ARTIFICIAL GROUND-WATER RECHARGE SYSTEM. Amer. Geophysical Union Trans. 38: 346-348. 1957. 330.9 Am3

Hydrostatic pressure measurements were made at fourteen depths below the surface of a large ground-water recharge system. These measurements showed the nature of the growth of the perched water tables resulting from the spreading operation. They demonstrated the importance of knowing subsurface stratigraphy for a considerable depth on the value to be derived from treatment of the surface soil to improve permeability. These factors also limit the potential capacity of a recharge area.

1279. Hall, W. A. OPTIMUM DESIGN OF A MULTIPLE-PURPOSE RESERVOIR. J. Hydraul. Div., ASCE 90(HY 4): 141-149. 1964. 290.9 Am3Ps

A method for the optimum design of a reservoir to provide regulated water for several purposes was described that separately allocates the water to the different purposes and then allows for the use of some of the water for more than one purpose. Dynamic programming was used to effect the optimum allocation in terms of a number of different values of regulated flow. Flood control storage was considered separately in terms of marginal cost and marginal benefit. The limitations of the approach arise from the limitations of the concept of "regulated flow". Extensions to overcome the limitations were indicated

1280. Hall, W. A., and Howell, D. T. ESTIMATING FLOOD PROBABILITIES WITHIN SPECIFIC TIME INTERVALS. J. Hydrol. 1(3): 265-271. 1963. 292.8 J82

A technique was presented for computing the probability that a flood of certain magnitude will be equaled or exceeded one or more times in any given time period. Values of this probability for floods of different return period were tabulated. The probabilities were then obtained of one or more occurrences in a given time period of floods in class intervals between magnitudes corresponding to certain return periods. The limitations of the technique were discussed.

1281. Hantush, M. S. FLOW OF GROUND WATER IN SANDS OF NONUNIFORM THICKNESS. I. FLOW IN A WEDGE-SHAPED AQUIFER. J. Geophysical Res. 67: 703-709. 1962. 470 J823

Formulas of ground-water flow through wedge-shaped aquifers were obtained for several flow systems of practical interest. It was assumed that the flow has no significant component of velocity in the γ direction so that its pattern is the same in all parallel vertical xz planes. The results were presented in terms of functions that are already available in tabular form, making these analytical expressions as easy to use as any other simple formula. These results showed that the flow in wedge-shaped aquifers cannot be approximated by the flow in aquifers of uniform thickness (as currently practiced) except during very short periods which become longer for points closer to the source of the flow.

1282. Hantush, M. S. FLOW OF GROUND WATER IN SANDS OF NONUNIFORM THICKNESS. II. APPROXIMATE THEORY. J. Geophysical Res. 67: 711-720. 1962. 470 J823

Several flow problems in an aquifer whose thickness varies linearly or exponentially in the x direction while remaining uniform in the γ direction were treated. Their solutions were based on a differential equation that has been set up to approximate the flow in such aquifers. Several initial and boundary conditions were considered. Some of the results were compared with those obtained in the first of this sequence of papers. It was concluded that the approximate solutions yield good results in sands confined by beds whose angles of dip have tangents less than 0.20. Also, the flow in wedge-shaped aquifers cannot be approximated by that which would exist if the aquifer were of uniform thickness except during very short periods which become longer for points closer to the source of flow.

1283. Hantush, M. S. FLOW OF GROUND WATER IN SANDS OF NONUNIFORM THICKNESS. III. FLOW TO WELLS. J. Geophysical Res. 67: 1527-1534. 1962. 470 J823

Ground water flow in sands of nonuniform thickness is concerned with unsteady flow toward wells completely penetrating an aquifer whose thickness may be assumed to vary exponentially in the direction of γ while remaining uniform in the γ direction. The drawdown induced around a flowing well (well of constant head) or around a well that is pumped at a constant rate is obtained for aquifers that can be considered effectively infinite in areal extent. The flow toward steadily discharging wells near a fairly straight and an effectively long stream, or near an impermeable boundary which completely cuts through the aquifer, is also considered. The results were compared with those which would be obtained if the aquifer were of uniform thickness.

1284. Haq, S. D. DEVELOPMENT OF THE COASTAL REGION OF EAST PAKISTAN BY EMBANKMENT. United Nations Econ. Comm. Asia Far East Water Resources Ser. 25: 152-159. 1963. 290.9 Un35F

A report was given on the proposed use of embankments in East Pakistan to protect crops from monsoon flood and saline water inundation.

1285. Harder, J. A. ANALOG MODELS FOR FLOOD CONTROL SYSTEMS. J. Hydraul. Div., ASCE 88(HY 2): 63-74. Mar. 1962. 290.9 Am3Ps

The success of applying analog model techniques to tidal flow channels has led to the extension of the technique to the simulation of flood control systems. The similarity relationships for long period flood waves were derived.

Methods for the simulation of the channel sections were described, with particular attention paid to the non-linear properties of the stage-discharge relation and the stage-storage relation. The introduction of boundary conditions in the form of streamflows and rainfall excesses was programmed for each 6 hours in the prototype, for a total period of 10 days, by special pinboards. Each simulated flood required 5 milliseconds, after which initial conditions of flow, at the initial instant of the 10-day period, were reestablished in preparation for the next flood period. The time history of stage or discharge at any 2 of 50 stations can be displayed simultaneously on an oscilloscope screen. Provision was made for the insertion of up to six reservoirs into the analog, each of which was provided with a programmable output simulating the action of reservoir release gates.

1286. Harder, J. A. ANALOG MODELS FOR FLOOD CONTROL SYSTEMS. Amer. Soc. Civil Engin. Trans. 128(1): 993-1004. 1963. 290.9 Am3

The success of applying analog model techniques to tidal flow channels has led to the extension of the technique to the simulation of flood control systems. The similarity relationships for long period flood waves were derived.

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1287. Hardin, J. R. EVOLUTION OF MISSISSIPPI VALLEY FLOOD-CONTROL PLAN. Amer. Soc. Civil Engin. Trans. 124: 207-223. 1959. 290.9 Am3

The development of the lower Mississippi Valley Flood-control plan was traced from its beginning with local levee construction at New Orleans, La., to the comprehensive plan presently (1958) being undertaken by the Corps of Engineers (United States Department of the Army). Flood-control methods for controlling the Mississippi River were analyzed.

1288. Harding, S. T. WATER IN CALIFORNIA. N-P Publications, Palo Alto, Calif. 231 pp. 1960. 292 H21

A discussion was given on water in California. Chapters on the following were included: History; laws and water rights; irrigation and drainage of irrigated lands; reclamation; flood control; recreation uses; multi-purpose projects; and future plans.

1289. Harris, B., Sharp, A. L., Gibbs, A. E., and Owen, W. J. AN IMPROVED STATISTICAL MODEL FOR EVALUATING PARAMETERS AFFECTING WATER YIELDS OF RIVER BASINS. J. Geophysical Res. 66: 3319-3328. 1961. 470 J823

An improved statistical model was given for evaluating parameters affecting water yields of river basins.

1290. Harrold, L. L. HYDROLOGIC RELATIONSHIPS ON WATERSHEDS IN OHIO. Soil Conserv. 26(9): 208-210. Apr. 1961. 1.6 So3

The hydrologic relationships of watersheds in Ohio were discussed.

1291. Harrold, L. L. ESTIMATING FLOOD VOLUMES AND HYDROGRAPHS CORRESPONDING TO PEAK FLOWS OF GIVEN FREQUENCIES FOR SMALL AGRICULTURAL WATERSHEDS. J. Geophysical Res. 67(11): 4341-4346. Ref. Oct. 1962. 470 J823

A method was presented for obtaining estimates of flow volumes and flood hydrographs corresponding to flood peak frequency values for watersheds of 20 to 20,000 acres. Flood flow volumes and hydrographs can be used for design purposes, as they are near the maximum that can be expected to occur with the flood peak of the chosen probability. The method was derived from watersheds at Coshocton, Ohio.

1292. Harrold, L. L., Brakensiek, D. L., McGuinness, J. L., Amerman, C. R., and Dreibelbis, F. R. INFLUENCE OF LAND USE AND TREATMENT ON THE HYDROLOGY OF SMALL WATERSHEDS AT COSHOCTON, OHIO, 1938-1957. U.S. Dept. Agr. Tech. B. 1256, 194 pp. 1962. 1 Ag84Te

Concepts of land management for water production and procedures to test the validity of these concepts with observed streamflow data from treated watersheds were developed. Land treatments evaluated in the study were for several levels of crop production and for timber production. These were: (1) Average crop production and average soil stability (prevailing practice); (2) high crop production and considerable soil stability (improved practice); and (3) management as a farm woodlot and complete soil stability. Concepts were developed from small, single cover watershed runoff data, lysimeter percolation data, ground-water well elevations, and soil physical data.

1293. Harrold, L. L., Marston, R. B., and Schwab, G. O. WATER CONSERVATION RESEARCH IN OHIO. Ohio J. Sci. 63(2): 49-55. Mar. 1963. 410 Oh3

A report was given on water conservation research in Ohio.

1294. Hartman, M. A., and Ree, W. O. STUDY DOWNSTREAM EFFECTS OF UPSTREAM WATERSHED IMPROVEMENTS. Soil Conserv. 28(9): 206-207. Apr. 1963. 1.6 So3S

A report was given on downstreams effects of upstream watershed improvements on: (1) Main-stem floods; (2) total flow of the river; (3) sediment flow; and (4) the stability of the river channel.

1295. Haushild, W., and Kruse, G. UNSTEADY FLOW OF GROUND WATER INTO A SURFACE RESERVOIR. Amer. Soc. Civil Engin. 127(1): 408-415. 1962. 290.9 Am3

Prediction of the water table position and the amount of water discharged where ground water is flowing from an aquifer to a surface reservoir has not been exact. The nonlinear partial differential equation that describes the shape of the water table is difficult to solve.

Approximate solutions obtained by tw different methods for the nonlinear equation were presented. Both approximate solutions agree better with experimental results than does the exact solution of the simplified linear equation for the flow.

With discussion by Messrs. M. E. Harr; R. G. Kazmann; W. T. Moody; K. T. S. R. Iyengar; and W. Haushild and G. Kruse. pp. 415-424.

1296. Heagy, K. A FLOODWAY FOR HOUSTON, TEX. Amer. Soc. Civil Engin. 123: 181-194. 1958. 290.9 Am3

The most suitable plan for the flood protection to the city of Houston, Tex., is one that provides for the continued operation of Barker Reservoir and Addicks Reservoir; for the rectified channel immediately downstream therefrom; and for the clearing, straightening, enlarging, and lining, where necessary, of the channels of Buffalo Bayou, Brays Bayou, and White Oak Bayou. Extensive studies were made and retention and diversion of flood waters were considered, but the rectification of natural channels proved to be the most desirable and economical plan.

1297. Heard, W. L. YAZOO-LITTLE TALLAHATCHIE IS A PAYING FLOOD PREVENTION PROJECT. Soil Conserv. 29(9): 203-204. 1964. 1.6 So3S

A report was given on the value for flood control of the Yazoo-Little Tallahatchie Watershed in Mississippi.

1298. Heinemann, H. G. SEDIMENT DISTRIBUTION IN SMALL FLOODWATER-RETARDING RESERVOIRS IN THE MISSOURI BASIN LOESS HILLS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-44, 37 pp. 1961. A56.9 R31

Considerable data were obtained on 23 small reservoirs in the Missouri Basin loess hills. Stage-capacity, capacity replaced by sediment, and sediment distribution curves were drawn for each. These curves were discussed in detail, compared with one another, and various findings given.

After making numerous graphical analyses, the multiple regression method was used to develop an equation to predict the minimum elevation of the principal spillway for floodwater-retarding structures. The variables used in this equation are: (1) Total original storage depletion; (2) original "n" value; (3) total storage capacity; and (4) sediment sample volume weight. Application of the results of the findings was suggested when sedimentation principles are the only criteria.

1299. Heinemann, H. G. USING THE GAMMA PROBE TO DETERMINE THE VOLUME-WEIGHT OF RESERVOIR SEDIMENT. Internatl. Assoc. Sci. Hydrol. Comn. Land Eros. 59: 410-423. 1962.

Determining the volume-weight of deposited sediment is a necessary part of a reservoir sedimentation survey. This unit of measurement is essential for converting data on accumulated sediment in a reservoir to information on sediment yield from the watershed, and for applying knowledge gained from surveys to the solution of other sedimentation problems.

The gamma probe is a practical instrument for obtaining the volume-weight of reservoir sediment. It operates on the principle that gamma rays from a Radium 226 source are scattered by electrons present in water and sediment. The amount of rays reflected back from an ellipsoid of about 1 cubic foot to Geiger-Muller detectors is inversely proportional to the wet volume-weight of the sediment in place. The dry volume-weight can be determined by adjusting for the absolute specific gravity of the sedimentary materials and using a calibration curve.

1300. Hellinga, F. AGRICULTURAL HYDRAULICS. (Fr) Gembloux. Inst. Agron. B. de l'Inst. Agron. et des Sta. de Rech. de Gembloux. Ser. Extraordinaire. 2: 629-635. 1960. 105.1 G285B
English summary.

A discussion was given on water control by irrigation, watering, polders, and drainage throughout the world.

1301. Hellinga, F. AGRICULTURAL HYDRAULICS. (Fr) Ann. de Gembloux. 67(4): 269-275. Fourth Q. 1961. 13 G28
English summary.

A report was given on water control by irrigation, watering, polders, and drainage in the Netherlands and throughout the world.

1302. Henderson, F. M. FLOOD WAVES IN PRISMATIC CHANNELS. Amer. Soc. Civil Engin. Trans. 129: 738-740. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a research study on flood waves in prismatic channels. The original article was published in J. Hydraul Div., ASCE 89(HY 4): 39-67. July 1963. The references to the discussions and closure were listed.

1303. Hickok, R. B. HYDROLOGY RESEARCH NEEDS FOR UPSTREAM FLOOD PREVENTION. Internatl. Comn. Irrig. and Drain. Cong. 5: 18.75-18.88. 1963. 55.9 In8A

Eight thousand three hundred small watersheds, up to 400 square miles in size, comprising half the land area of the U.S.A., need flood protection and related land and water resources development. Their protection and development may be authorized for joint projects of local, State, and Federal agencies under Public Law-566.

A discussion was given on the research being conducted and further research needs for this problem.

1304. Hobbs, H. W. HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES 1956-59. U.S. Dept. Agr., Agr. Res. Serv. Misc. P. 945, irregular pp. 1963. 1 Ag84M

Selected hydrologic data for the calendar years 1956-59, inclusive, were presented. Monthly precipitation and runoff data for 157 watersheds, annual maximum discharges and annual maximum volumes of runoff for 142 of the watersheds for time-intervals of 1, 2, 6, and 12 hours and for 1, 2, and 8 days, and detailed information for one or more selected typical storm events for 134 of them were given.

1305. Holtan, H. N. ACTUAL AND ESTIMATED FLOODING ON A PROTECTED WATERSHED: SANDSTONE CREEK, OKLA. U.S. Dept. Agr., Soil Conserv. Serv. SCS-TP-129. May, 1956. 1.96 Ad6Tp

Methods used in analyzing stream flow data were described. Analyses of some of the first records of flows with a flood-reduction program in actual operation during two major storms were given.

1306. Holtan, H. N., Minshall, N. E., and Harrold L. L., comt. FIELD MANUAL FOR RESEARCH IN AGRICULTURAL HYDROLOGY. U.S. Dept. Agr., Agr. Hbk. 224, 215 pp. June 1962.

Techniques and procedures currently used in the Soil and Water Conservation Research Division were given as an aid to field personnel in the initiation and maintenance of research projects.

1307. Hoorn, J. W., Van. GROUND-WATER FLOW IN BASIN CLAY SOIL AND THE DETERMINATION OF SOME HYDROLOGICAL FACTORS IN RELATION WITH THE DRAINAGE SYSTEM. (Du) Wageningen. Cent. v. Landbpub. en Landbdoc. Verslagen van Landbk. Onderz. 66(10): 136. Ref. 1960. 105.2 V61V English summary.

A report was given on the ground water flow in basin clay soil and the determination of some hydraulic factors in relation with the drainage system in the Netherlands.

1308. Horn, D. L., and Schwab, G. O. EVALUATION OF RATIONAL RUNOFF COEFFICIENTS FOR SMALL AGRICULTURAL WATERSHEDS. Trans. ASAE 6(3): 195-198, 201, 233. 1963. 290.9 Am32T

Improved runoff coefficients were developed for the rational method of peak runoff rate prediction. The rational formula was evaluated by using the derived coefficients and five methods of estimating time of concentration.

1309. Huang, S. P. THE QUESTION OF THE CHANGE IN RUNOFF RATE IN CHEKIANG AND DROUGHTS AND FLOODS. (Ch) Zhejiang Nongye Kexue. 1(44): 29-34. Jan. 1964. 22.5 C413

1310. Hubbell, D. W., and Sayre, W. W. SAND TRANSPORT STUDIES WITH RADIOACTIVE TRACERS. J. Hydraul. Div., ASCE 90(HY 3): 39-68. May 1964. 290.9 Am3Ps

Radioactive tracer techniques provided a feasible means for applying Lagrangian techniques to the observation of sediment transport processes in natural rivers and laboratory flumes. The transport of bed-material particles was described as a sequence of alternating steps and rest periods of random length and duration. The assumption of exponentially and identically distributed incremental step lengths and rest periods led to a longitudinal concentration-distribution function that agreed with experimental results obtained in the North Loup River, Nebr., and in a laboratory flume. Bed-material discharge was computed from a continuity equation in which the velocity was defined by the rate of movement of the mean position of a group of tracer particles, and the area was defined as the average cross-sectional area of the bed through which the tracer particles were distributed.

1311. Ignatyuk, C. L. PROBLEMS OF FLOOD CONTROL IN DELTAIC AREAS OF THE SOVIET UNION. United Nations Comm. Asia Far East Water Resources Ser. 23: 204-208. map. 1963. 290.9 Un35F

1312. Indiana Flood Control and Water Resources Commission. INVESTIGATION OF KANKAKEE AND YELLOW RIVERS, INDIANA FOR FLOOD CONTROL AND MAJOR DRAINAGE. Indianapolis. 10 pp. 1957. 290 In26

A progress report was given on flood control and major drainage on the Kankakee and Yellow Rivers in Indiana.

Flood protection levees were considered justified for 520 acres of farm land that gave a benefit-cost ratio of 2.1 to 1. Other areas need further study as their benefit-cost ratio was close to 1 to 1.

There is an extensive drainage system in the area, both open ditch and tile. This does not operate efficiently since the main stream channels have not been fully improved to act as a waterway to carry away the runoff that comes from the tributaries.

1313. Izu, T., Ota, K., and Kobayashi, M. STUDIES ON THE MECHANISM OF RUN-OFF FROM LOW LANDS. III. (Ja) Gifu U. Facul. Agr. Res. B. 12: 271-282. Ref. Dec. 1960. 107.6 G364 English summary.

A report was given on the mechanism of run-off from low lands in Japan for the design of drainage systems.

1314. Jager, A. W. De., and Kusse, A. D. DETERMINATION OF DISCHARGE BY MEANS OF STREAM SPEED MEASUREMENT. (Du) Nederland. Heidemaatsch. Tijdschr. 75(3): 126-133. Mar. 1964. 12 N282

1315. Jenkins, E. D., and Moulder, E. A. GROUND-WATER TECHNOLOGY AND LITIGATION PROBLEMS. J. Irrig. and Drain. Div., ASCE 88(IR 2): 21-32. June 1962. 290.9 Am3Ps

Water in Colorado commonly is adjudicated on the principle of "first in time, first in right". Surface-water rights generally are senior to ground-water rights and the presumption of the courts is that most, if not all, ground water in the State is a part of the "natural stream". Ground-water development in Colorado is often delayed by tedious and costly litigation. Ground-water technology has played and will continue to play an important role in facilitating better water legislation. A detailed evaluation of local hydrology can materially assist the court in making an equitable decision.

1316. Jennings, A. R. EVALUATION OF SELECTED RADIOISOTOPES AS GROUND-WATER TRACERS. Diss. Abs. 25(4): 2445-2446. Oct. 1964. 241.8 M58

An evaluation was given on the use in Texas of selected radioisotopes as ground-water tracers.

1317. Johnson, L. E. FIVE KANSAS WATERSHED PROJECTS JOINED IN FLOOD—OTHER BENEFITS. Soil Conserv. 29(9): 205-206. 1964. 1.6 So3S

A report was given on the combined value for flood control and other benefits of five separate watershed projects in Kansas. There is a special intershed committee made up of representatives of each district board of directors.

1318. Johnson, L. G. FLOODS AND FLOOD CONTROL IN THE MISSOURI RIVER BASIN. Diss. Abs. 20(9)· 3701. Mar. 1960. 241.8 M58

An abstract was given of a thesis on floods and flood control in the Missouri River Basin.

1319. Jones, H. I. KIOWA SERVES AS PILOT FOR WATERSHEDS IN COLORADO. Soil Conserv. 26(9): 196-198. Apr. 1961. 1.6 So3S

A report was given on the Kiowa Pilot watershed project in Colorado.

1320. Kano, T., Hayashi, N., Nakagawa, S., and Furuki, T. RESULTS OF INVESTIGATIONS AND TESTS ON THE CHARACTERISTICS OF THE ESTUARY. (Ja) Tokyo Natl. Inst. Agr. Sci. Misc. P. Ser. F (Agr. Engin.) 1956(3): 1-31. Mar. 1956. 290.9 T57M English summary.

In Japan, often the ground-water level rises or surface water stands in flat and low culivated areas contiguous to seashore, caused by the insufficient drainage of the estuary. Investigations and tests were made to lower the inter-water level by appropriate treatments of the estuary. Methods of treatments for each practical case were reported.

1321. Kaufman, W. J. TRITIUM AS A GROUND WATER TRACER. Amer. Soc. Civil Engin. Trans. 126(3): 436-446. 1961. 290.9 Am3

Tritium in the form of tritiated water is a nearly perfect ground water tracer. Its only serious disadvantage is derived from its radioactive properties and the potential effects on public health of extremely small concentrations of radioisotopes. The potential biological risks of using tritium in large scale water tracing operations were treated and compared with the possible benefits.

1322. Kaufman, W. J., and Orlob, G. T. AN EVALUATION OF GROUND-WATER TRACERS. Amer. Geophysical Union Trans. 37: 287-296. 1956. 330.9 Am3

The ideal ground-water tracer should correctly depict the movement of water through a porous medium without modifying the transmission characteristics of the system. Cationic materials, including radioisotopes and certain organic dyes, are generally unsatisfactory and anionic radioisotopes when used without stable carriers may be largely retained by adsorption. Chloride may be satisfactorily used where density effects can be avoided and dispersion of clays is not likely. Organic materials are subject to decomposition by soil microorganisms and hence their value as water tracers are limited. Tritium, when used as tritiated water, may exchange with soil bound water with a resulting reduction in velocity of the tracer front.

1323. Keller, W. D. ACIDITY-ALKALINITY OF SURFACE DRAINAGE WATERS AS RELATED TO UNDERLYING SILICATE ROCKS. J. Sedimentary Petrology. 30: 582-584. 1960. 398.8 J82

Surface drainage waters in humid regions underlain by silicate rocks range in pH from about two units above to several units below neutrality. Alkaline waters were observed in regions underlain by pyroclastic rocks and nepheline syenite, whereas acid surface waters were measured where the underlying rocks were gneisses, granites, and certain other igneous rocks. The pH of the surface water is interpreted as being influenced by the hydrolytic (alteration) products of the rocks—the more alkaline water being associated with the silicate rocks most susceptible to hydrolysis.

1324. Kennedy, E. J. STREAMFLOW RECORDS BY DIGITAL COMPUTER. J. Irrig. and Drain. Div., ASCE 89(IR 3): 29-36. 1963. 290.9 Am3Ps

The automation of streamflow-record computation was examined. Records for an increasing number of gaging stations operated by the United States Geological Survey are now being processed automatically by a general-purpose digital computer from charts of new, automatic, digital water-stage recorders. Exhibits from one automated gaging station were used to illustrate the process.

Automatic data processing reduced office work on a typical record from approximately 10 to less than 5 man-days per year. The work performed by the computer was the unpleasant part, namely, the drudgery. Preliminary studies indicated relatively small monetary savings, approximately 10 percent less than for manual computation. Computer mistakes were uncommon and usually more obvious than the mistakes found in manual computation.

1325. Kennedy, J. F. STATIONARY WAVES AND ANTIDUNES IN ALLUVIAL CHANNELS. Calif. Inst. Tech. Rpt. No. KH-R-2, 146 pp. 1961.

A theoretical and laboratory investigation was reported on antidunes and associated stationary waves. The factors involved in the formation of antidunes, the characteristics of the stationary waves, and the effects of antidunes and waves on the friction factor and sediment transport capacity of streams were determined.

1326. Kennedy, J. F. FURTHER LABORATORY STUDIES OF THE ROUGHNESS AND SUSPENDED LOAD OF ALLUVIAL STREAMS. Calif. Inst. Tech. Rpt. KH-R-3, 36 pp. 1961.

A laboratory study was reported on the variation with depth and velocity of the hydraulic and sediment transport characteristics of a constant-discharge flow. Eight experimental runs were performed in a 60-foot long, 33.5-inch wide recirculating laboratory flume. The unit discharge for all runs was 0.50 c.f.s. (cubic feet per second) per foot and the velocity was varied from 0.91 to 2.21 f.p.s. (feet per second), corresponding to a change in depth from 0.550 to 0.228 feet. The bed sand used for these experiments had a geometric mean sieve diameter of 0.142 mm. and a geometric standard deviation of 1.38.

1327. Keppel, R. V., and Renard, K. G. TRANSMISSION LOSSES IN EPHEMERAL STREAM BEDS. J. Hydraul. Div., ASCE 88(HY 3): 59-68. May 1962. 290.9 Am3Ps

Data from the Walnut Gulch Experimental Watershed, Tombstone, Arizona was reported showing transmission losses in ephemeral streams that have coarse-textured alluvial beds. The decreases in flow volume in the downstream direction are typically large because of the high intake rates and low moisture content of the channel alluvium. These flow abstractions exert a profound influence on hydrograph characteristics of ephemeral streams and also effect the water yield-area relation of semiarid watershed.

1328. Kimura, D. ON THE SEEPAGE IN THE TORRENT COURSE. (Ja) Kagoshima U. Facul. Agr. B. 6: 212-221. Dec. 1957. 107.6 K114B
English summary.

A report was given on flood control needs in Japan that investigated the surface running water, percolation in the hillside, seepage in the river, and the effects of springs in the river.

1329. Kindingstad, E. MATHEMATICAL MODEL FOR TRANSIENT RIVER FLOW. J. Hydraul. Div., ASCE 90(HY 3): 23-38. May 1964. 290.9 Am3Ps

The mathematical modeling of transient river flow involves the following major problems: (1) It is necessary to describe mathematically the propagation of the water already in the river; and (2) methods must be established for predicting local inflow to the main river stem as a result of rainfall or snow melting. The solution to the first problem was presented.

Mathematical models for flood routing that are in common use today (1964), neglect river dynamics altogether in order to simplify longhand computation. This limitation can be overcome by using a high-speed digital computer to solve the more complete dynamic river problem. The mathematical model presented was based on Bergerson's numerical method for the solution of plane wabe phenomena.

1330. Kinori, B. Z., and Dlayahu, E. ECONOMIC EVALUATION OF DRAINAGE AND FLOOD CONTROL WORKS WITH SPECIAL REFERENCE TO SEMI-ARID CONDITIONS. Cong. Irrig. and Drain. Trans. 5(3): R.15.455-R.14.472. 1963. 55.9 C7652

A report was given on the economics of drainage and flood control works. Special reference was given to semi-arid conditions in Israel.

1331. Klyueva, K. A. ON THE EFFECT OF MARSH DRAINAGE ON RIVER DISCHARGE. 5 pp. (OTS 60-21891) Transl. 12282
Translation from Meteorologiya i Gidrologiya. 1959(6): 17-20. 1959.

A discussion was given on the effect of marsh drainage on river discharge in the U.S.S.R.

1332. Knapp, J. W., and Schaake, J. C., Jr. MEASURING RAINFALL AND RUNOFF AT STORMWATER INLETS. J. Hydraul. Div., ASCE 89(HY 5): 99-115. Sept. 1963. 290.9 Am3Ps

Relatively simple instrumentation was developed to measure and record rainfall and runoff on small urban areas draining to storm water inlets. The instruments include a tipping bucket rain gage, weirs, and head sensing devices installed inside storm water inlets, and a multiple pen recorder. Runoff into as many as six storm water inlets was recorded at a single location. Controls were provided to operate the instruments automatically during storms. The occurrence of rainfall and runoff closes switches, sending pulses to the recording pens, and a synchronous record of the events was compiled on a single continuous chart. A chart speed of 1-1/2 inches per minute permitted evaluation of the data in small increments of time. Power was obtained from a 12-VDC storage battery.

The equipment was designed to be installed with little modification of existing drainage facilities. Field tests and model studies were used to determine discharge characteristics of the inlet weirs.

1333. Knisel, W. G., Jr. BASEFLOW RECESSION ANALYSIS FOR COMPARISON OF DRAINAGE BASINS AND GEOLOGY. J. Geophysical Res. 68: 3649-3653. 1963. 470 J823

By means of baseflow recession analysis, a method of comparing drainage basins and geologic formations with the aquifers at maximum performance was developed. With the technique, it is possible to analyze data for perennial and intermittent streams. A minimum of subjective judgements is involved, so that comparable results can be obtained from independent investigations. The baseflow recession curve is assumed to be a decay-type curve. The maximum aquifer capacity can be determined from integration of the maximum recession curve. Baseflow data were analyzed for 61 drainage basins representing 9 geologic formations in the south-central United States, and the relative ground water storage of the formations were evaluated.

1334. Knutsson, G. Cr^{51}-EDTA AND SOME OTHER TRACERS FOR MEASURING OF GROUNDWATER FLOW. (Sw) Grundforbattring. 17(2): 145-156. Ref. 1964. 54.8 G92
English summary.

A report was given on the use of radioactive tracers for measuring ground water flow in Sweden.

1335. Krause. COASTAL PLAN IN EASTERN FRISIA. (Ge) Praxis u. Forsch. 8: 42, 45. Mar. 27, 1956. 18 P89

1336. Kropper, H. J. DAMS, DIKES, AND GENERAL IMPROVEMENTS FOR FLOOD CONTROL. (Excerpts.) Conn. Woodlands. 21: 10. Jan. 1956. 99.8 C76

Excerpts from a talk given at the Conservation Conference, Hotel Bond, Hartford, Conn., were given that stressed the use of dams, dikes, and general improvements for the flood control.

1337. Krzyszowski, J. HYDROLOGY AND GENERAL CHARACTERISTICS OF THE VISTULA DELTA LANDS IN THE LIGHT OF THEIR SOIL AND MORPHOLOGY FEATURES. (Pol) Rocz. Gleboznawcze. 10(sup): 768-769. 1961. 56.8 R592

1338. Kunkle, G. R. THE BASE-DURATION CURVE, A TECHNIQUE FOR THE STUDY OF GROUNDWATER DISCHARGE FROM A DRAINAGE BASIN. J. Geophysical Res. 67: 1543-1554. 1962. 470 J823

The baseflow-duration curve provides a technique for the comparative study of base runoff from the same or different drainage basins. The curve is a cumulative frequency curve showing the percentage of time that specified base flows were equaled or exceeded during a given time period. Daily base flows are obtained from a hydrograph separation of base and surface runoff. Although the separation may not be precise, the value of the technique as a comparative tool is not lost as long as a consistent method of separation is followed. When bank storage is present within a basin, the base runoff can be separated on the hydrograph into two components, designated bank- and basin-storage discharge. These are differentiated on the baseflow-duration curve by the shape of the curve. The baseflow-duration curve allows comparisons of total base runoff and the base runoff components.

1339. Lall, S. DAMODAR VALLEY CORPORATION—LARGEST MULTI-PURPOSE PROJECT FOR FLOOD CONTROL, IRRIGATION AND ELECTRICITY. Major Indus. India Annu. 9: 311, 313, 315, 317, 319. 1959-60. 280.9 M282

A report was given on the Damodar Valley Corporation in India which is the largest multipurpose project for flood control, irrigation, and electricity.

1340. Langbein, W. B. GEOMETRY OF RIVER CHANNELS. J. Hydraul. Div., ASCE 90(HY 2): 301-312. Mar. 1964. 290.9 Am3Ps

Hydraulic principles, as developed in firm boundary channels, appear insufficient to explain the form and profile of river channels. In nature, stream channels attain a most probable state that must fulfill the necessary hydraulic laws, and in addition, fulfill its degrees of freedom by tendency to equal distribution among velocity, depth, width, and slope. This principle was tested by the use of three examples. Another example explored the accommodation of a river channel to changing discharge. The last example was that of a river free to adjust its profile, velocities, depths, and widths to accommodate the downstream increase in discharge. Each of these examples appeared to satisfy the postulate presented in this paper.

1341. Langbein, W. B., and Hoyt, W. F. WATER FACTS FOR THE NATIONS FUTURE; USES AND BENEFITS OF HYDROLOGICAL DATA PROGRAMS. Ronald Press, N.Y. 303 pp. 1959. 292 L253

A book of water facts. Ways the information can be used for hydrological data programs were presented.

1342. Langewiesche, W. THE DUTCH HUSTLE. Harper's Mag. 212(1271): 67-72. Apr. 1956. 110 H23

A report was given on the development and maintenance of reclamation and flood control project for the Netherlands.

1343. Laurand, J. THE IMPORTANCE OF HYDROGEOLOGICAL FIELD RESEARCH IN PLANNING DRAINAGE. (Rus) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 22: 15-26. 1961. 106 Es83 English summary.

A report was given on the importance of studying the hydrogeology of excessively wet land in Estonia to provide the most economical drainage for the area.

1344. Leenheer, L. De. IS THERE AN INCREASING DANGER OF INUNDATION AND A CONTINUOUS RISE OF THE WATER TABLE IN THE POLDER-AREA OF THE EAST-FLANDERS PROVINCE? HOW IS THE PRESENT SITUATION OF WATER-TABLE CONTROL IN THESE POLDERS? (Fl) Ghent. Landbhogesch. Meded. 29(2): 509-526. map. 1964. 105.1 G344

A study was reported of the average water level at high tide, low tide, and mid tide in the Scheldt over a 60 year period. This information gives a general view of the present-day problem of water table control in the polder area of the Scheldt and Durme rivers.

1345. Leonard, R. L. INTEGRATED MANAGEMENT OF GROUND AND SURFACE WATER IN RELATION TO WATER IMPORTATION; THE EXPERIENCE OF LOS ANGELES COUNTY. Giannini Found. Agr. Econ. Res. Rpt. 279, 90 pp. Oct. 1964. 281.9 G34M

A report was given on the intergrated management of ground and surface waters in relation to water importation in Los Angeles County of California.

1346. Leur, D. A. K. van de. SOME EFFECTS OF THE UNSATURATED ZONE ON NONSTEADY FREE-SURFACE GROUNDWATER FLOW AS STUDIED IN A SCALED GRANULAR MODEL. J. Geophysical Res. 67(11): 4347-4362. Ref. Oct. 1962. 470 J823

Symmetrical free-surface flow of ground water to outflow channels was studied in a scaled granular model employing screened sand and a spirit-water mixture. Differences between observed and computed hydrographs were analyzed in a combined study of unsaturated and saturated flow.

1347. Li, C. H. THE UNDERGROUND WATER AND THE RECENT SALINIZATION OF THE SOIL IN THE SUNG-NUN PLAIN. (Ch) Acta Pedol. Sinica. 12(1): 34-42. map. Ref. Mar. 1964. 56.9 Ac8 Russian summary.

1348. Lindberg, H. R. LITTLE SIOUX FLOOD PREVENTION. Soil Conserv. 29(9): 209-210. 1964. 1.6 So3S

A report was given on the value and use of terraces, grassed waterways, flood retention dams, and other conservation practices on individual farms for flood protection of the Little Sioux watershed programs in Iowa.

1349. Linsley, K. K., Jr., Kohler, M. A., and Paulhus, J. L. H. HYDROLOGY FOR ENGINEERS. McGraw-Hill Book Co. 340 pp. 1958. 292 L65H

A textbook was given on hydrology for engineers.

1350. Long, H. H. "WATERSHED PHILOSOPHY" SPREADS ALONG HADLEY CREEK AND BEYOND. Soil Conserv. 29(11): 260-261. 1964. 1.6 So3S

A report was given on the advantages of the watershed approach for flood control in Illinois.

1351. Loreen, E., and Boddy, H. WASHINGTON FARMERS SOLVING PROBLEM OF TOO MUCH WATER. Soil Conserv. 29(9): 211-212. 1964. 1.6 So3S

A report was given on the advantages of the watershed approach for flood control and more effective farm drainage in Washington.

1352. Luscynski, N. J. HEAD AND FLOW OF GROUND WATER OF VARIABLE DENSITY. J. Geophysical Res. 66(12): 4247-4256. Ref. Dec. 1961. 470 J823

Fresh-water and environmental-water heads were shown to be useful in studying movement of ground water of variable density, such as in a system of fresh, diffused, and salt water.

An equation showing a relation between the head observed in fresh water overlying diffused water and the elevation of the contact between fresh water and diffused water was given. The equation is based on the concept of environmental head. It was found to be a suitable basis for defining the specific limitations of the Ghyben-Herzberg and the Hubbert equations when they are used for fresh-diffused-salt water environments.

1353. McDonald, H. R., and Wantland, D. GEOPHYSICAL PROCEDURES IN GROUND WATER STUDY. J. Irrig. and Drain. Div., ASCE 86(IR 3): 13-26. 1960. 290.9 Am3Ps

The principles of the geophysical methods most useful in ground water exploration were described and illustrated. In addition, a new application of the electrical borehole logging was described which may be of great importance in locating leaky zones in irrigation canals.

The four major geophysical methods—the seismic, the electrical, the magnetic, and the gravity method were used. The one most suited in a given case should be used.

1354. McGuinness, J. L., and Brakensiek, D. L. SIMPLIFIED TECHNIQUES FOR FITTING FREQUENCY DISTRIBUTIONS TO HYDROLOGIC DATA. U.S. Dept. Agr. Hbk. 259, 42 pp. 1964.

Simplified procedures for fitting the most commonly used distributions in hydrologic frequency analysis—the normal, extreme-value, log-normal, and modified log-normal distributions—were given. The modified log-normal distribution is well suited for the case where a specific statistical distribution is not or cannot be postualted. In addition to fitting procedures, a simple test of the hydrologic representativeness of a set of hydrologic data was outlined.

1355. McGuinness, J. L., and Harrold, L. L. SEASONAL AND AREAL EFFECTS ON SMALL-WATERSHED STREAMFLOW. J. Geophysical Res. 67: 4327-4334. 1962. 470 J823

The small-area streamflow regimen at Coshocton was found to be regulated primarily by the seasonal effect of evapotranspiration. Size of area as an index of geological conditions was a significant modifier of the streamflow pattern. An investigation of the seasonal and areal effects with duration and frequency of flow showed that the seasonal effect caused a sinuous relationship between flow volumes and durations of flow. Nomogram charts of the relationships for high and low flows were developed for obtaining flow estimates which may be modified by rainfall and other factors for application in the Allegheny Plateau region.

1356. McGuinness, J. L., Harrold, L. L., and Amerman, C. R. HYDROGEOLOGIC NATURE OF STREAMFLOW ON SMALL WATERSHEDS. J. Hydraul. Div., ASCE 87(HY 1): 1-13. Jan. 1961. 290.9 Am3Ps

The importance of watershed area in depth-area-duration-frequency relationships on streamflow from small watersheds was investigated. Size of area was found to be an index of geologic and geomorphologic properties of the watersheds. Area index was related to annual streamflow and also to flows of as short as 2- or 8-day duration. A reconnaissance survey of base flow and a preliminary geologic investigation in one of the watersheds helped clarify the interrelationships between the geologic and hydrologic aspects of the study.

1357. McHenry, J. R. A TWO-PROBE NUCLEAR DEVICE FOR DETERMINING THE DENSITY OF SEDIMENTS. Internatl. Assoc. Sci. Hydrol. (65): 189-202. 1963. 292.9 As7

Nuclear techniques were employed to measure the density of reservoir sediments in place, and the concentration of suspended sediments. A dual probe was used in these studies. This instrument uses two access tubes which house the radioactive, cesium-137, source and the detector system, respectively. The detector is a sodium iodide (thallium activated) scintillation crystal and the electronic read-out system employs a modified integral discriminator so that only the gamma rays exceeding 0.65 Mev are recorded by the scaler-ratemeter.

Excellent precision and accuracy were obtained with the dual probe in laboratory experiments. The maximum thickness of the measured volume of sediment was less than 1-inch.

The performance of the dual probe was compared in a field survey with the single gamma probe which utilizes the reflection technique of measuring gamma attenuation. The dual probe performed satisfactorily in the field and in addition offered the unique advantage of determining densities of narrow sediment bands and at interfaces.

1358. McHenry, J. R., and Dendy, F. E. MEASUREMENT OF SEDIMENT DENSITY BY ATTENUATION OF TRANSMITTED GAMMA RAYS. Soil Sci. Soc. Amer. Proc. 28(6): 817-822. Nov./Dec. 1964. 56.9 So3

The measurement of density by observing the attenuation of transmitted gamma rays was adapted to the measurement of sediment density. A dual probe, utilizing transmission techniques, was evaluated for use in measuring the density of sediments collected from runoff of plots or small watersheds.

The dual probe employed measured densities of sediments to within 0.01 absolute density units. The vertical resolution of the apparatus is less than 1 inch so that density measurements of thin layers and of materials at interfaces can be made. In one field test sediment weights, of the order of 8,500 pounds, computed for a silt box on the basis of dual probe density determinations varied less than 1 percent from a gravimetric determination. Changes in sediment density with time, with additional increments of sediment, and with storms were effectively measured.

1359. McIntyre, R. R. CONSTRUCTION OF DAMS ON TIDAL RIVERS. Trans. ASAE 5(1): 82-85. 1962. 290.9 Am32T

A report was given on the construction of dams on tidal rivers to protect agricultural lands in Canada.

1360. Malinovskii, G. A. RECLAMATION AND UTILIZATION OF FLOOD LAND OF SMALL RIVERS IN THE SOUTH-EAST (OF U.S.S.R.). (Rus) Zemledelie. 5(7): 57-61. July 1957. 20Z44

1361. Mamack, W. RIVER REGULATION. OTS 61-31301. 380 pp. 1964. 290 M312Ae

An English translation was given of the Book "River Regulation" published in Poland in 1958.

1362. Mandel, S. UNDERGROUND WATER SALINITY IN THE COASTAL LOWLANDS. (He) Hassadeh. 36: 484-485. Mar. 1956. 26 H27

1363. Manson, P. W., and Miller, D. G. GROUNDWATER FLUCTUATIONS IN CERTAIN OPEN AND FORESTED BOGS OF NORTHERN MINNESOTA. Minn. Agr. Expt. Sta. Tech. B. 217, 29 pp. Dec. 1955. 100 M66

A report was given on ground water fluctuation in drained and undrained peat bogs in open and forested areas in Minnesota.

1364. Maris, A. G. HOLLAND'S DELTA PLAN OF DEFENCE AGAINST THE SEA. Progress (London) 44: 277-282. Autumn 1955. 280.8 P949

A report was given of the Delta plan to prevent floods in Holland. Ditches are used for both drainage and irrigation.

1365. Markov, P. V. ECONOMICS AND FINANCING OF IRRIGATION, DRAINAGE AND FLOOD CONTROL DEVELOPMENTS IN THE U.S.S.R. Cong. Irrig. and Drain. Trans. 5(2): R.15.71-R.15.82. 1963. 55.9 C7652

A report was given on the economics and financing of irrigation, drainage, and flood control developments in the U.S.S.R.

1366. Marston, R. B. PARISH CANYON, UTAH: A LESSON IN FLOOD SOURCES. J. Soil and Water Conserv. 13: 165-167. 1958. 56.8 J822

For 82 years the abundant clear water supplied by Parrish Creek contributed to the prosperity of Centerville, Utah. But in the summer of 1930 this creek went on a rampage that resulted in a series of four grinding, smashing mudrock floods that deposited 329.9 acre feet of sediment within the town and on surrounding farms. This sediment ranged in size from fine soil particles to huge boulders weighing from 100 to 200 tons.

A commission was set up to study the problem and the following conclusions were made: The Parrish Creek drainage was in stable condition for many years before people settled near it. The normal rate of erosion while it was in this table condition was low. Heavy grazing and burning of the watershed slopes rendered them unstable and increased the sedimentation rate 1,000 times or more. On plots in the head of the canyon, sedimentation rates have been increased from 0 to 5.49 acre feet per square mile of watershed during one storm, and decreased from 3.94 acre feet per square mile to 0 during a similar storm by manipulation of the vegetal cover.

1367. Mathrani, M. P. IRRIGATION, DRAINAGE, AND FLOOD CONTROL SCHEMES IN NORTH BIHAR. In BIHAR, 1954-55. Bihar, Patna, Pub. Relat. Dept. pp. 50-52. 1955. 280.8 B48

1368. Mendoza-Von-Borstel, F. WATER SUPPLY AND DRAINAGE FOR THE NAUCALPAN-ZARAGOZA-TLALNEPANTLA ZONE AND PROTECTION AGAINST FLOODS IN THE ZONE AND MEXICO CITY. (Sp) Ingen. Hidraul. en Mex. 16(3): 59-72. maps. July/Sept. 1962. 290.8 In43
English summary, buff pages, pp. II-III.

A report was given on the water supply, drainage requirements, and flood control in Mexico.

1369. Metz, R. C. COMMUNITY WATERSHED PROJECT BRINGS MANY BENEFITS. Soil Conserv. 28(7): 160-161. 1963. 1.6 So3S

A report was given on the advantages of a community watershed project in Kansas—especially for flood control and wildlife from the six floodwater-retention dams. The use of soil conserving methods on the individual farms has been greatly speeded up and additional benefits are being derived from the terraces, grass waterways, grass seeding, etc.

1370. Meyboom, P. ESTIMATING GROUND WATER RECHARGE FROM STEAM HYDROGRAPHS. J. Geophysical Res. 66: 1203-1214. 1961. 470 J823

It is possible to separate graphically the base flow on stream hydrographs by plotting the logarithm of the discharge against time. Total potential ground water discharge (Q_{tp}) at the beginning of any given base-flow recession is

$$Q_{tp} = K_1K_2/2.3$$

where K_1 = ground-water discharge at the beginning of the base-flow recession (t_o), in acre feet per day; K_2 = time increment corresponding to one log cycle change in Q, in days.

This method of hydrograph analysis is believed to be a potentially useful method of evaluating a regional ground-water balance. It gives quantitative information regarding the entities that make up the basic hydrologic equation.

1371. Midgley, A. R. WATER TABLE STUDIES IN SOME VERMONT SOILS. Vt. Agr. Expt. Sta. B. 597, 19 pp. Ref. Feb. 1957. 100 V59

A report was given on the measurement of watertables on three major river valleys in Vermont and the effect of high water tables on crops and soils in the area.

1372. Miller, A. E. THIS DAM HAS PAID FOR ITSELF—AND THEN SOME. Land Impr. 6(8): 18. 1959. 282.8 L224

Black River Dam in the Green River Watershed, was completed in December 1956. Since then, the 245 farmers and rural residents living on 3,000 acres of truck crop land along the river have enjoyed three flood-free years; although floods have risen to a height of from 21 to 26 feet on the Green River five times.

Commonly quoted damage figures were $20- to $30,000 a year before the dam was built. The cost of the dam, $38,498, could have been covered by the losses of any two floods.

In addition to 3,000 acres directly benefited, another 8,000 acres in Drainage District No. 1 are helped by improved drainage during flood periods.

1373. Miller, C. R., and Borland, W. M. STABILIZATION OF FIVEMILE AND MUDDY CREEKS. J. Hydraul. Div., ASCE 89(HY 1): 67-97. Jan. 1963. 290.9 Am3Ps

Since the Riverton Project, in arid central Wyoming, began operations in 1925, Fivemile Creek has been used as the principal drainageway for carrying off irrigation wastes. With the extension of the Wyoming Canal in 1950, Muddy Creek also began to carry waste flows. Under natural conditions, both streams were ephemeral and flowed only as a result of storms or snowmelt. By 1952, the annual discharge had increased from less than 5,000 acre-feet to over 90,000 acre-feet on Fivemile Creek and over 20,000 acre-feet on Muddy Creek.

On Fivemile Creek, the combination of seepage, high sustained waste flows, and natural floods resulted in a condition that greatly accelerated the erosion along the channel. By 1952, the deterioration of Fivemile Creek had become so severe that effective erosion control measures were necessary. This stream alone was contributing 49 percent of the sediment flowing into Boysen Reservoir.

1374. Minshall, N. E. PREDICTING STORM RUNOFF ON SMALL EXPERIMENTAL WATERSHEDS. Amer. Soc. Civil Engin. 127(1): 625-646. 1962. 290.9 Am3

Careful estimates of rates and amounts of runoff are required for design of flood retarding and channel stabilizing structures, and bridges and culverts in small upstream watersheds. The period of record of many of the small experimental watersheds in the United States is too short to permit direct analysis for reliable estimates of the magnitude and frequency of storm runoff. A method was presented for extending the period of runoff records based on analysis of existing short term records of rainfall and runoff for the watershed, and a longer record of the rainfall alone. The method involves: (1) Estimating storm runoff volumes from the rainfall pattern and antecedent rainfall, and (2) distributing this runoff through an adaptation of the unit hydrograph principle. A method was also presented for developing synthetic unit hydrographs for ungaged areas.

With discussion by Messrs. Jaime Amorocho; Merwin D. Dougal; Robert L. McFall and Ben A. Jones, Jr.; and Neal E. Minshall. pp. 646-659.

1375. Moore, C. M. PERFORMANCE OF FLOOD PREVENTION WORKS DURING THE 1957 FLOODS. J. Hydraul. Div., ASCE 85(HY 10): 37-51. Oct. 1959. 290.9 Am3Ps

The spring storms of 1957 fully tested a great number of upstream floodwater retarding structures and provided a large scale field test by which the hydrologic, design, and construction criteria could be evaluated. The evaluation confirmed the fact that vegetated earth spillways for flood prevention structures can be safely used in connection with detention dam operation, involving a controlled outlet and temporary storage to reduce frequency of operation of emergency spillways. This principle of design resulted in significant reductions in the cost of the structures and at a very low relative cost for maintenance following spillway operation.

The effectiveness of watershed protection and flood prevention work in preventing flood damages was demonstrated, and the effects of similar work in all creek watersheds in the 3-state area in which it appears to be feasible was discussed. Through the process of filling, releasing, and refilling during the storm period the structures detained and released in an orderly manner almost twice the volume of floodwater as the combined flood detention capacity for which the structures were designed.

1376. Moran, P. A. P. THE STATISTICAL TREATMENT OF FLOOD FLOWS. Amer. Geophysical Union Trans. 38: 519-523. 1957. 330.9 Am3

The estimation of return periods of floods was considered from the point of view of mathematical statistics. This requires, essentially, the estimation of the tail of a probability distribution from a sample of values which is usually not dense in this tail. The error in the estimation of a flood corresponding to a given probability arises from two sources: (1) The uncertainty as to the mathematical form of the distribution; and (2) the uncertainty arising from the statistical errors of estimation of the parameters of the distribution which occur because of the finiteness of the length of record. These errors were illustrated on a numerical example by fitting a log-normal distribution and a type III distribution to fifty annual values of extreme monthly flow of the River Murray.

1377. Morgan, P. E., and Johnson, S. M. ANALYSIS OF SYNTHETIC UNIT-GRAPH METHODS. J. Hydraul. Div., ASCE 88(HY 5): 199-220. Sept. 1962. 290.9 Am3Ps

The basic unit-graph theory has been accepted as one of the best methods available for determining rainfall-runoff relationships from a drainage basin. Information derived from this theory may be used to determine hydraulic flows to be used in the design of highway culverts, storm sewers, spillways, bridges, and flood protection structures.

To use the unit-graph theory, adequate rainfall and runoff records must be available to develop typical unit hydrographs for the basins involved. Most drainage basins have sufficient rainfall data available; however, stream-flow records are inadequate in most areas. To overcome this shortage of actual records, several synthetic methods have been proposed for developing unit graphs.

The relative accuracy with which four of these synthetic methods reproduce the actual unit graph for the basin was determined. The peak flow variations were from 198 percent above to 69 percent below the actual observed peak flows for 12 selected basins.

1378. Morisawa, M. E. QUANTITATIVE GEOMORPHOLOGY OF SOME WATERSHEDS IN THE APPALACHIAN PLATEAU. Geol. Soc. Amer. B. 73: 1025-1046. 1962. 403 C29

Geometry of 15 watersheds in the Appalachian Plateau province conformed to Horton's laws of drainage composition in horizontal, or planimetric, properties but not in vertical, or relief, properties. Geologic structure and varying lithology interacted to change vertical form elements and cause deviations from Horton's laws.

Geometric similarities and differences in watershed morphology provide both quantitative and qualitative bases for grouping the regions studied into three distinct sections. Dissimilarities, although distinct, are not great.

Simple correlations of hydrologic and geomorphologic features provide the basis for choice of characteristics to use in a multiple regression on peak-runoff intensity. A regression of peak intensity of runoff on basin area, rainfall intensity and frequency, and topography had a high correlation coefficient and was significant at the 0.001 level.

1379. Morita, H. STUDIES ON THE HYDROLOGICAL ANALYSIS OF THE DRAINAGE FROM AN ALLUVIAL LOWLAND. I. (Ja) Yamagata U. B. 4(2): 189-205. map. Ref. Mar. 1963. 22.5 Y1
English summary.

Some hydrological surveys were reported of Nitsu districts on the relation between drainage and rainfall in the Niigata Pretecture of Japan.

1380. Moser, B. D. TEAM EFFORT SOLVES ANNUAL FLOOD PROBLEM. Land and Water Conser. 2(6): 12-13. 1960. 56.8 L222

After flood-testing their newly completed watershed project this past winter, the people of Saar Valley in Whatcom county, Washington, report more gains from their team undertaking than they had hoped for.

The Saar Creek project in its first flood season took charge of a 26 year record flow so well that improved channels used only two-thirds of their capacity. And for the first time in the memory of the valley's residents, farmlands, roads, and homes at flood stage were high and dry.

1381. Mosonyi, E., and Pichler, J. FLOOD CONTROL, IRRIGATION AND DRAINAGE IN HUNGARY'S PLAIN LANDS. Internatl. Comn. Irrig. and Drain. Annu. B. 1961: 50-68. maps. 1961. 55.9 In8A

A detailed report was given on flood control, irrigation, and drainage in Hungary's plain lands.

1382. Myers, L. E., and Van Bavel, C. H. M. MEASUREMENT AND EVALUATION OF WATER TABLE ELEVATIONS. Internatl. Comn. Irrig. and Drain. Cong. 5: 17.109-17.119. 1962. 55.9 C7652

Water-table elevations may be measured by several methods. Direct methods, which are pressure measurements, include open wells, piezometers, and tensiometers. Precautions must be taken to avoid errors due to storage and vertical flow components. Indirect methods include neutron scattering and gamma densitometry procedures which provide information concerning water distribution in the soil profile. Seismic and electrical resistivity methods may be suitable for reconnaissance surveys.

1383. Nakano, H., Kikuya, A., Morisawa, M., and Taira, K. ON THE RELATION BETWEEN THE TOPOGRAPHY OF DRAINAGE BASINS AND SPECIFIC FLOOD DISCHARGE. (Ja) Jap. Forestry Soc. J. 45(4): 121-124. Apr. 1963. 99.8 N62

1384. Nakayama, F. S. APPLICATION OF TRITIUM TRACER IN SOIL AND PLANT WATER INVESTIGATIONS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-37, 12 pp. Sept. 1960. A56.9 R31

A report and review of the literature on the use of tritium (H^3) as a tracer for ordinary hydrogen (H^1) in soil and plant water investigation was given.

1385. Naor, I. FELLOWSHIP REPORTS ON GROUND-WATER HYDROLOGY. F.A.O. Fellowship in the U.S. Tel-Aviv, 1963. various pp. (Water Planning for Israel P.N. 275) 1963. 292 N15

The fellowship reports were given of a study in the United States on ground water hydrology.

1386. Natal'in, B., and Almazov, B. EXPERIMENT IN RECLAMATION OF FLOOD PLAINS. (Rus) Sel'sk. Khoz. Sibiri. 1957(6): 37-40. June 1957. 20 Se492

1387. Nelson, H. T. WATER-TABLE FLUCTATIONS RESULTING FROM IRRIGATION DEVELOPMENTS. Cong. Irrig. and Drain. Trans. 5(5): R17.121-R17.160. Ref. 1963. 55.9 C7652

A report was given on the effect of irrigation by diversion of surface waters and withdrawal of ground water on associated ground water aquifers in the Pacific Northwest region of the United States. The prevention of drainage to irrigated land and facilities through ground water control by drainage was discussed.

1388. Newton, D. W. STORMS AND FLOODS ON SMALL AREAS. J. Geophysical Res. 65(7): 2117-2123. Ref. July 1960. 470 J823

A complete analysis of the flood potential of a watershed must include an estimate of the maximum expected flood discharge. A simplified, easily applied procedure for areas of up to approximately 500 square miles was outlined. The procedure was based upon a determination of the maximum expected storm. Storm transposition techniques and information published by the U.S. Weather Bureau and the Corps of Engineers are used in making this determination. A basic family of depth-area-duration curves was found, by use of relationships developed by the the U.S. Weather Bureau to envelop observed storms in a meteorologically homogeneous region. These basic data were further adjusted to conform to the moisture potential of the watershed in question. Standard techniques were used to compute the precipitation excess and the flood hydrograph.

1389. Nobe, K. C., and Dill, H. W. EVALUATION OF AGRICULTURAL FLOOD DAMAGE BY AIRPHOTO ANALYSIS OF FLOODPLAIN SAMPLES. Agr. Econ. Res. 11(4): 102-106. Oct. 1959. 1 Ec7Agr

A report was given on the use of airphoto analysis for evaluation of Agricultural flood damage.

1390. Noce, G. D. MOUNTAIN TORRENTS. (It) Avvenire Agr. 72(12): 300-301. Dec. 1964. 16 Av9

1391. Nordin, C. F., Jr. STUDY OF CHANNEL EROSION AND SEDIMENT TRANSPORT. J. Hydraul. Div., ASCE 90(HY 4): 173-197. 1964. 290.9 Am3Ps

Observations of channel erosion, flow, and sediment transport for the Rio Puerco, in New Mexico, indicated that the characteristics of the channel and of the channel material changed rapidly because of deposition and erosion, and that the ephemeral flows carried extremely high concentrations of suspended sediment that influenced flow and transport characteristics.

1392. Obukhov, A. D. ELIMINATION OF MAIN DAMS IN FLOOD GATES WITH SIDE OUTFLOW. (Rus) Sel'sk. Khoz. Sev. Kavkaz. 1958(5): 77-79. May 1958. 20 Se495

1393. Ojefors, E. LOWERING THE LEVEL OF THE OLAND RIVER. (Sw) Lantbrtdskr f. Stockholms Lan och Stad. 9(2): 7-9, 11-13. 1959. 12 L29

1394. Onishchenko, B. P. FLOODLANDS OF THE WESTERN POLESYE OF THE UKRAINIAN S.S.R. AND THEIR RECLAMATION. (Rus) Moscow. Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy 37: 193-200. 1962. 292.9 M85

1395. Ou, Y. A. WATER CONTROL ON THE CHING RIVER, HUNAN PROVINCE. Shangai, Shin-hua Shu-tien, 75 pp. 1954. 290 Ou1

1396. Packer, R. J. CONSERVATION GROUND-WATER CONTROL RESCUES COUNTY ROAD—FARMLAND. Soil Conserv. 28(7): 150-151. 1963. 1.6 So3S

A report was given on group action in Montana for providing a drainage ditch to control the ground water in an irrigated area.

1397. Parker, F. L. RADIOACTIVE TRACERS IN HYDROLOGIC STUDIES. Amer. Geophysical Union Trans. 39: 434-439. 1958. 330.9 Am3

The use of radioactive tracers to study phenomena in hydrology that have not previously been easily amenable to investigation is proceeding at a rapid pace. A group of experiments was carried out in lakes and reservoirs in Massachusetts to determine eddy diffusion coefficients. The average eddy diffusion coefficient divided by the radius of the eddy was found to be 0.09 ft./sec. A group of experiments to determine the average velocity of streams and the dilution in streams by use of radioactive tracers was then performed. The diffusion coefficients found in the test of the streams were compared with the theoretical diffusion coefficients of G. I. Taylor for straight pipes and found to be larger due to the increased dispersion caused by bends and obstructions in the stream. A mathematical formulation for general use in determining dilution and dispersion in rivers and streams by radioactive tracers was established. A correction was made for the absorption and decay of the isotope depending upon its chemical and nuclear properties.

1398. Parker, G. G. GROUND WATER IN THE CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT. Soil and Crop Sci. Soc. Fla. Proc. 20: 211-231. maps. Ref. 1960. 56.9 So32

A report was given on ground water in central and southern Florida Flood Control District and its effect on flood control, drainage, and irrigation.

1399. Parsons, D. A. EFFECTS OF FLOOD FLOW ON CHANNEL BOUNDARIES. J. Hydraul. Div., ASCE 86(HY 4): 21-34. Apr. 1960. 290.9 Am3Ps

Interesting facts, learned in studies of stream bank stabilization methods in western and central New York State by the Agricultural Research Service, were given. The studies, for the most part, consisted of attempts to relate observed effects of floods as evidenced by damages to stream bank revetment, to the channel geometry, and the qualities of the flood flows.

1400. Parsons, D. A. EFFECTS OF FLOOD FLOW ON CHANNEL BOUNDARIES. Amer. Soc. Civil Engin. Trans. 126(I): 136-156. 1961. 290.9 Am3

Some general and particular things of interest, learned in studies of stream bank stabilization methods in western and central New York State by the Agricultural Research Service, were given. The studies, for the most part consist of attempts to relate observed effects of floods as evidenced by drainages to stream bank revetment, to the channel geometry, and the qualities of the flood flows.

1401. Pemberton, E. L. SEDIMENT INVESTIGATIONS—MIDDLE RIO GRANDE. J. Hydraul. Div., ASCE 90(HY 2): 163-185. Mar. 1964. 290.9 Am3Ps

The middle Rio Grande Valley in New Mexico extends approximately 163 river miles. A comprehensive data collection program was developed for use in a channel rectification plan that would alleviate the aggradation problem caused by sediment depositions. River ranges were resurveyed to determine the rates and volume of aggradation or degradation or both in the river channel and flood plain. Channel hydraulics and sediment data were collected at special reaches of the river not affected by natural or artificial restrictions such as bridges. As a result of special analyses, the modified Einstein procedure was adopted for computing the total sediment load at a single cross section for 301 special measurements.

The data were used to develop total sediment load rating curves and hydraulics and sediment transport relationships in the design of channel rectification in the Middle Rio Grande Valley.

1402. Perk, G. D., Kuiperi, H. G., and Elkema, L. WATER MANAGEMENT IN NORTH ITALY. (Du) Landbk. Tijdschr. 68: 511-527. Feb./Mar. 1956. 105.2 Or3

1403. Perrey, J. I. SUGGESTED LEGISLATION ON FLOOD PLAIN REGULATION. J. Hydraul. Div., ASCE 85(HY 12): 43-51. Dec. 1959. 290.9 Am3Ps

Although all states have provisions for administering water resources activities in some state agency to some degree, many of the agencies lack adequate powers to deal with flood problems, to collect basic data, or to administer regulations. Many are inadequately financed and staffed. The states' effort should: (1) Support local flood plain regulations; (2) collect basic flood data and prepare flood evaluation reports; (3) provide advice and technical service to local planning agencies in flood plain matters; (4) administer state floodway—encroachment and dam—safety provisions; (5) provide levee inspection and require adequate levee maintenance for urban areas; and (6) cooperate with federal agencies.

The federal government should: (1) Adopt a policy that will require local regulation of flood plains where indicated in federal flood control projects; (2) enlarge the program for the collection of basic flood data; (3) prepare flood-evaluation reports particularly in regions that cross state boundaries; and (4) establish criteria for determining the extent to which loans on private construction in flood plain areas would be guaranteed by federal agencies.

1404. Pinto, J. F. R. ECONOMIC AND FINANCIAL ASPECTS OF IRRIGATION, DRAINAGE AND FLOOD CONTROL WORKS IN PORTUGAL. (Fr) Cong. Irrig. and Drain. Trans. 5(2): R.15.213-R.15.215. 1963. 55.9 C7652
English summary.

A report was given on the economic and financial aspects of irrigation, drainage, and flood control works in Portugal.

1405. Podymov, B., and Mogoryanu, N. SOIL-RECLAMATIONAL CHARACTERISTICS OF THE FLOODLANDS OF THE DNIESTER, THE PRUT AND THE REUT. (Rus) Zeml. i Zhivotn. Moldavii. 12: 17-19. Dec. 1962. 20 Z45

1406. Poland, J. F. LAND SUBSIDENCE DUE TO GROUND-WATER DEVELOPMENT. J. Irrig. and Drain. Div., ASCE 84(IR 3, 1774): 11. Ref. Sept. 1958. 290.9 Am3Ps

A report was given on land subsidence due to ground water development in California.

1407. Polubarinova-Kochina, P. Y. THEORY OF GROUND WATER MOVEMENT. Princeton, Princeton U. Press, 1962. 613 pp. 1962. 292 P762Ae
Translated from the Russian.

This book on the theory of ground water movement was translated from the Russian by J. M. Rodger DeWiest.

1408. Potapov, F. M. RECLAMATION OF LOW-LAYING FLOOD PLAIN LANDS. (Rus) Sel'sk. Khoz. Sev.-Zapadnoi Zony. 10: 24-26. Oct. 1962. 20 Se497

1409. Pough, R. H. LOWLANDS ARE THE HEART OF A WATERSHED. Va. Wildlife. 22(2): 7. 1961. 410 V81

Respect for the integrity of a watershed as it has been carved by the forces of nature should be the key to its management. The contours of the land and the character of the natural bodies of temporary and permanent water that occupy a watershed represent a dynamic equilibrium. The factors involved in such an equilibrium are: (1) Rainfall, especially the large amounts that can occasionally fall over rather short periods; (2) the ratio of in-soak to run-off on various parts of the watershed; and (3) the balance between the temporary storage capacity of swamps and marshes and the capacity of the stream channel to carry off water.

Marshes and swamps act as "safety valves," filling with water during periods of peak rainfall—water which they slowly and automatically feed into the river as it rids itself of its overload and its level falls. Where many such "safety valves" were part of the original equilibrium, river channels were never very deep or wide, as the run-off from even a heavy storm could be handled with only a moderate increase in stream flow.

1410. Powers, W. L. LAND RECLAMATION PROGRESS IN IRAQ. Agr. Engin. 37: 334, 341. May 1956. 58.8 Ag83

A report was given on land reclamation in progress in Iraq. The program of irrigation and drainage was designed to fully utilize the waters of the lower Tigris and Eurphrates Rivers for irrigation, flood control, power, and navigation.

1411. Press, H. ECONOMY AND FINANCING OF INSTALLATIONS FOR IRRIGATION, DRAINAGE AND FLOOD CONTROL. Cong. Irrig. and Drain. Trans. 5(3): R.15.335-R.15.338. 1963. 55.9 C7652

A discussion was given on the economy and financing of installations for irrigation, drainage, and flood control in Germany.

1412. Raudkivi, A. J. STUDY OF SEDIMENT RIPPLE FORMATION. J. Hydraul. Div., ASCE 89(HY 6): 15-33. Nov. 1963. 290.9 Am3Ps

Laboratory results were used to show the variation of the bed friction factor with the formation of ripples and dunes under flowing water. The flow pattern in the lee of a ripple was compared with the wake at an abrupt expansion. For the latter, the flow pattern and results of turbulence measurements were shown in graphical form. Velocity, pressure, and shear stress measurements on a fixed ripple form were examined. An explanation was proposed for the mechanism of the formation of the regular ripple pattern. It was reasoned that the increased agitation and sediment entrainment where the interface, between the main flow and the wake, meets the boundary was responsible for the upstream sloping face of the ripple. The regular pattern will persist only as long as the wake was dissipated before it reached the next ripple crest. The ripple height was determined when the surface drag over the ripple crest was on the point of exceeding the value it had for the same flow over the flat sand bed.

1413. Reed, J. E., and Bedinger, M. S. PROJECTING THE EFFECT OF CHANGED STREAM STAGES ON THE WATER TABLE. J. Geophysical Res. 66(8): 2423-2427. Aug. 1961. 470 J823

The position and shape of the water table under certain conditions may be considered to be the sum of two components of head, namely, the boundary component and the accretion component. In an aquifer of given hydraulic characteristics, the boundary component of head is determined by the stream stage and areal shape of the aquifer; the accretion component of head is determined by vertical gain or loss of water to the aquifer and by the areal shape of the aquifer. The boundary component may be obtained by electric-analog methods. By subtracting the boundary component from the observed position of the water table, the accretion component can be obtained. A change in river stage imposes a new boundary component on the system. The effect of changed stream stages on the water table may be obtained by adding the accretion component to a new boundary component caused by changed stream stages.

1414. Reich, B. M. ANNOTATED BIBLIOGRAPHY AND COMMENTS ON THE ESTIMATION OF FLOOD PEAKS FROM SMALL WATERSHEDS. Civil Engin. Sect., Colo. State U. CER60-BMR52, 66 pp. 1960.

Some one hundred and eighty books and articles were reviewed for information of value in the estimation of peak runoff from small watersheds in and around the size range from 200 acres to three square miles. Their contents were abstracted with emphasis on material pertinent to design methods and classified according to sixteen subject headings. The most useful estimation methods were briefly discussed, with special reference to procedures followed by the USDA Soil Conservation Service. Research programs were proposed which could bridge the gap between existing data and the application of more refined estimation techniques in countries where hydrometeorology is less advanced than it is in USA.

1415. Reinhart, K. G. APPROXIMATING SOIL-MOISTURE STORAGE IN EXPERIMENTAL WATERSHEDS BY MEANS OF PRECIPITATION AND STREAMFLOW RECORDS. Soil Sci. Soc. Amer. Proc. 28(4): 575-578. 1964. 56.9 So3

An estimate of total soil-moisture storage capacity of an experimental watershed is needed to understand its hydrology. A reliable estimate may be very difficult to obtain, particularly in a forested watershed, because of variations in and difficulties of measuring soil depth, root depth, texture, bulk density, stone content, and moisture content. A method was suggested for approximating storage from precipitation and streamflow records. Precipitation minus runoff—in selected periods when ample precipitation follows a dry spell—provided the estimate of soil-moisture storage capacity. The method was illustrated with data from the Fernow Experimental Forest in West Virginia and was applied to two other watersheds in the Northeast. Limitations of the method were discussed.

1416. Reinhart, K. G. EFFECT OF A COMMERCIAL CLEARCUTTING IN WEST VIRGINIA ON OVERLAND FLOW AND STORM RUNOFF. J. Forestry. 62(3): 167-171. 1964. 99.8 F768

A commercial clearcutting was made on a 74-acre gaged watershed on the Fernow Experimental Forest; skidroads were loggers' choice—without limitations as to grade or provisions for drainage. After-logging, infiltration rates in the watershed remained well above maximum rainfall intensities except on portions of the skidroads. Overland flow occurred only from the skidroads; it resulted from the combination of rain directly on the skidroads and interception of subsurface flow by the road cuts. Increased storm runoff in the growing seasons—up to a maximum of about one-half area-inch in any one storm—was largely the result of decreases in field-moisture deficiency rather than changes in the proportions of surface and subsurface flow.

1417. Reinhart, K. G., and Pierce, R. S. STREAM-GAGING STATIONS FOR RESEARCH ON SMALL WATERSHEDS. U.S. Dept. Agr., Agr. Hbk. 268, 37 pp. 1964. 1 Ag84Ah

A report was given on the need and use of stream gaging stations for research on small watersheds.

1418. Richards, B. D. FLOOD ESTIMATION AND CONTROL. Ed. 3. Chapman and Hall, Ltd. 187 pp. 1955. 290 R39

A third edition was given of a book on flood estimation and control in England.

1419. Robinson, A. R. EVALUATION OF THE VANE-TYPE FLOW METER. Agr. Engin. Instrument News Sec. 44: 374-375, 381. 1963. 58.8 Ag83

A report was given on the evaluation of a vane-type flow meter in laboratory and field trials in Colorado.

1420. Rowe, P. B. STREAMFLOW INCREASES AFTER REMOVING WOODLAND-RIPARIAN VEGETATION FROM A SOUTHERN CALIFORNIA WATERSHED. J. Forestry 61: 365-370. 1963. 99.8 F768

A test of applied watershed management on the San Dimas Experimental Forest in southern California showed that streamflow yields could be appreciably increased. This was accomplished by clearing the deep-rooted woodland-raparian vegetation from selected canyon bottom reaches of Monroe Canyon. The increases in flow were especially important because they occurred primarily in summer and in the initial period of soil wetting during succeeding rainy seasons, when streamflow was lowest and water most needed.

1421. Rowe, R. R., Long, G. L., and Royce, T. C. FLOOD FREQUENCY BY REGIONAL SYNTHESIS. Amer. Geophysical Union Trans. 38: 879-884. 1957. 330.9 Am3

Design of highway bridges in California has been predicated on waterways required for 30-year to 100-year floods. Determination of such floods is highly speculative because of relatively short stream-flow records. Longer records for an average stream of a hydrologically homogeneous region have been synthesized by combining nondimensional peak discharges, so as to derive factors for extrapolation of frequency curves for each stream of the region.

Reliability of the method, depending upon definition of homogeneity of a region, was tested by a graphical comparison. The test was devised by hypothesizing a "perfect" 1000-year flood record and dividing it by chance distribution into twenty 50-year records. Superimposed frequency graphs of these 20 hypothetical records gave a visual measure of disparities to be expected in natural records of comparable streams.

The paper, illustrated by charts, briefs the development of the graphical test, describes the application to one region in California, and shows similar results in a second region of entirely different character.

1422. Rumer, R. R., Jr., and Harleman, D. R. F. INTRUDED SALT-WATER WEDGE IN POROUS MEDIA. J. Hydraul. Div., ASCE 89(HY 6): 193-220. Nov. 1963. 290.9 Am3Ps

A laboratory model of a two-dimensional confined aquifer containing an isotropic, homogeneous, porous medium was used to investigate the gravitational convection and dispersion of salt water. An equation for the rate of movement of the intruding wedge toe was presented and experimentally verified for the case of zero net fresh ground water flow to the ocean. The earlier theoretical work of Henry in defining the equilibrium position of the intruded wedge was experimentally confirmed. The extent of the zone of dispersion at the salt-fresh interface due to the steady fresh water flow to the ocean was treated analytically, and reasonable agreement was found experimentally. The additional interfacial mixing due to tidal effects was shown to be governed by a longitudinal and a lateral coefficient of dispersion that are functions of the pore system geometry of the medium and the tidally-induced seepage velocities.

1423. Rzhanitsyn, N. A. MORPHOLOGICAL AND HYDROLOGICAL REGULARITIES OF THE STRUCTURE OF THE RIVER NET. U.S. Dept. Agr., Agr. Res. Serv., Soil and Water Conserv. Res. Div. Unnumbered translated reprint, 380 pp. 1960 (reprint 1964). 292 R99Ae

Average characteristics of river channels were given and the regularities of their changes along the length of the river and at confluences where two smaller rivers form a new, larger one were outlined. The individual characteristics of rivers which determine the relief of the channel were examined. The possibility of applying the obtained relationships in the solution of problems in modeling the channel process and in calculating the longitudinal profiles of rivers were shown by examples.

This book was written for hydrologic engineers and technicians and was translated from Russian by D. B. Krimgold.

1424. Sato, S., and Iijima, H. IMPROVEMENT OF DRAINAGE BY A CLOSING LEVEE AT RIVER MOUTH. Cong. Irrig. and Drainage Trans. 3(5): 10.147-10.158. map. 1957. 55.9 C7652

A report was given on a plan in Japan to improve drainage and prevent saline trouble in the area by closing the levee at the river mouth. The hydraulic studies made on the effectiveness of the closure of the river mouth by a closing levee and the operation of the gates were described.

1425. Schaller, F. W., and Riley, B. G. THE WATER PROBLEM IN IOWA. Iowa Agr. Expt. Sta. B. P-122, 24 pp. Jan. 1957. 100 Io9

A discussion was given on the water problem in Iowa by a condensed version of many of the seminar papers presented at a water resource seminar held at Ames, Iowa in 1956.

1426. Schleusener, R. A., Smith, G. L., and Grant, L. O. FINAL REPORT: STUDY OF PEAK RATES OF RUNOFF IN EASTERN COLORADO AND ADJACENT AREAS. Civil Engin. Sect., Colo. State U. CER60-RAS31, 95 pp. and plates. 1960.

The factors affecting peak rates of runoff in the semi-arid region of eastern Colorado and adjacent areas were studied. Within this region, annual maximum floods on watersheds less than 1000 square miles are usually the result of intense rainfall over a limited area. The investigation reveals that peak rates of runoff from ungaged watersheds can be estimated from parameters of watershed area, channel slope, and a soil infiltration index in the region east of the Rocky Mountain Foothills.

In the Rocky Mountain Foothills, estimates of peak rates of runoff from ungaged watersheds can be made using watershed contributing area, elevation, and location.

Design procedures for estimating peak rates of runoff in these regions were illustrated by examples.

1427. Schulte-Wulwer. WISHES OF AGRICULTURE ON LAND IMPROVEMENT FOR INCREASING PRODUCTIVITY IN AGRICULTURE IN EASTERN FRISIA AND NORTH OLDENBURG IN LINE WITH THE COASTAL PROGRAMS. (Ge) Praxis u. Forsch. 8: 37-38. Mar. 27, 1956. 18 P89

1428. Scott, H. A. WATER CONTROL IN CENTRAL AND SOUTHERN FLORIDA. Amer. Soc. Civil Engin. Trans. 122: 211-227. 1957. 290.9 Am3

The historical efforts made to provide drainage and water control for central and southern Florida were described. Distribution and utilization of water in the comprehensive plan for flood control and multiple purposes were described. The need for a secondary water-control plan was emphasized.

1429. Scott, V. H., and Luthin, J. N. INVESTIGATION OF AN ARTESIAN WELL ADJACENT TO A RIVER. J. Irrig. and Drain., ASAE 85(IR 1): 45-62. Ref. Mar. 1959. 290.9 Am3Ps

A pump test was described of an artesian well in a problem area located adjacent to a river in California. Water moved from the river through a semi-confined aquifer and then vertically upward into the problem area. Results indicated that pumping for drainage was not justified.

1430. Selim, M. A., and Shahien, M. M. EFFECT OF NILE AND CANAL WATER LEVELS ON SUBSOIL WATER MOVEMENT IN IRRIGATED FARMS. Cong. Irrig. and Drain. Trans. 3(3): 8.17-8.32. map. 1957. 55.9 C7652

The effects of the Nile, canals, and irrigation applications on the existing water tables were studied near Cairo, Egypt.

1431. Semenenko, A. N. SOME PROBLEMS OF FORMATION OF UNDERGROUND WATERS ON IRRIGATED RICE FIELDS OF KUBAN LOWLAND. (Rus) Gidrotekh. i. Melior. 7: 14-20. Ref. July 1964. 290.8 G362

1432. Sewell, J. I., and van Schilfgaarde, J. PREDICTION OF WATER YIELDS FROM AGRICULTURAL WATERSHEDS. Soil Sci. Soc. Amer. Proc. 26: 82-85. 1962. 56.9 So3

Available runoff data were used in developing a method for predicting the water yields from agricultural watersheds in the Southeast. The watersheds were classified according to size, cover, geographical location, and season of year; and, weighted quadratic relationships of runoff on rainfall were computed by machine techniques. This method can utilize local rainfall data in making runoff predictions on a frequency basis. In developing a simplified and easily used technique, complicated watershed classifications were minimized.

A method was developed which allows more realistic estimation of runoff from small watersheds in the Southeast than by current techniques. This simple technique requires only the substitution of properly chosen rainfall quantities into the prediction equation to obtain monthly or annual runoff predictions.

1433. Sharp, A. L., Gibbs, A. E., Owen, W. J., and Harris, B. APPLICATION OF THE MULTIPLE REGRESSION APPROACH IN EVALUATING PARAMETERS AFFECTING WATER YIELDS OF RIVER BASINS. J. Geophysical Res. 65: 1273-1286. 1960. 470 J823

The efficacy of the use of the multiple correlation and regression approach in evaluating parameters affecting water yields of river basins was examined. Results of several analyses of annual and monthly streamflow of the Delaware River Basin in Kansas were presented to provide a background for an examination of the method.

It was concluded that: (1) Although the multiple regression approach will result in a line of best fit and best estimating equation for hydrologic data, it is not safe to place too much reliance on values estimated by such equations, particularly at levels far removed from the mean, despite very high correlation coefficients; and (2) some of the more modern statistical procedures may be better tools than the multiple regression approach for evaluating effects of watershed parameters on water yield.

1434. Sharp, A. L., and Saxton, W. E. TRANSMISSION LOSSES IN NATURAL STREAM VALLEYS. J. Hydraul. Div., ASCE 88(HY 5): 121-142. Sept. 1962. 290.9 Am3Ps

A study of fifty-seven selected flood events on eighteen rivers in the Great Plains (the United States), that have tandem stream-gaging stations indicated transmission losses averaged 40 percent of flood flows between upper and lower gaging stations averaging 53 valley miles apart. Losses of over 200 acre-feet per valley mile, approximately 75 percent of flood volumes, were found.

1435. Sheerar, L. L. MODEL FOR RIVER REGULATION. Amer. Soc. Civil Engin. Trans. 129: 847-848. 1964. 290.9 Am3

A digest was given of an article written on a model for river regulation. The original publication was published in the J. Waterways and Harbors Div., ASCE 89(WW 4): 13-27. Nov. 1963.

1436. Siline-Bektchourine, A. I. CONDITIONS OF FORMATION OF SALINE WATERS IN ARID ZONES. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 43-47. 1961. 278.9 Un3

The conditions favoring the formation of saline ground water in arid zones were discussed.

1437. Singh, K. P. NONLINEAR INSTANTANEOUS UNIT-HYDROGRAPHY THEORY. J. Hydraul. Div., ASCE 90(HY 2): 313-347. Mar. 1964. 290.9 Am3Ps

The proposed equation for instantaneous unit hydrographs (IUHs) contains the following physically-significant parameters: K_1, the overland storage-discharge factor; K_2, the channel storage-discharge factor; T, the time of concentration; and a functional parameter, $w(\tau)$, called the concentration-time diagram.

Analysis of hyetographs and hydrographs for various storms over six drainage basins indicated a definite relationship between the parameters T and K_2, and the instantaneous equivalent rainfall excess, R_e. Nonlinearities in the instantaneous unit hydrographs derived from surface-runoff hydrographs caused by different storms over the same drainage basin were accounted for by the parameters of the IUH equation. Procedures for the analysis of data to establish relations between the parameters and R_e, and the use of established relations to derive a surface-runoff hydrograph from a given effective hyetograph were explained and supplemented by examples.

1438. Sloan, D. E. SICK WATERSHED GETS TREATMENT. Soil Conserv. 26(9): 199-200. Apr. 1961. 1.6 So3S

The watershed protection program of the Elk Creek watershed in Indiana was described.

1439. Smirnov, A. V. DRAINAGE AND RECLAMATION OF FLOOD LANDS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Del'skokhoziaistvennoi Literatury, 1956. 94 pp. Ref. 1956. 54 Sm4

1440. Smith, C. E. UPSTREAM FLOOD PREVENTION: OVER-ALL APPROACH IN THE UPPER HOCKING WATERSHED. Agr. Engin. 42: 416-419. 1961. 58.8 Ag83

Within the past 25 years, flood prevention work in the United States has grown from concentrated efforts in flood control measures on our major rivers to include measures for preventing floods in our myriads of tributary streams affecting both agricultural and urban properties.

The upstream flood prevention programs have expanded from major emphasis on erosion control by means of various land-treatment practices to include structural measures for stabilizing eroding water courses, retarding flood flows, and improving channel capacities.

The Upper Hocking pilot watershed in Ohio is a working example of the current approach to upstream flood prevention work. Besides the land treatment work, which has its greatest effect upon reduction of erosion and sediment damages in the watershed, 22 stabilizing structures were included along with eight floodwater-retarding structures to control a total of 52 percent of the drainage area above the city of Lancaster.

1441. Smith, G. FLOODS AND FLOOD CONTROL. In Smith, G., ed. CONSERVATION OF NATURAL RESOURCES. Ed. 2. pp. 259-282. maps. Ref. Wiley, N.Y. 1958. 279.12 Sm5

A report was given on floods and flood control in the United States.

1442. Smith, G. S. WATERSHED PROJECT BRINGS FLOOD-FREE HIGHWAY. Soil Conserv. 28(11): 256-257. June 1963. 1.6 So3S

A report was given on the advantages of a small-watershed project in New Hampshire.

1443. Snyder, F. F. SYNTHETIC FLOOD FREQUENCY. J. Hydraul. Div., ASCE 84(HY 5) 1808: 1-22. Oct. 1958. 290.9 Am3Ps

A procedure was given for computing the flood discharge probability associated with a given rainfall-duration-frequency pattern on natural drainage basins, non-channelized overland flow areas and areas with storm sewer drainage utilizing basin runoff-producing characteristics of area, length, slope, friction, and shape. The approach was patterned after the so-called rationa method and utilizes the time of concentration concept with a unit hydrograph interpretation, but recognizes and evaluates separately the effect of storage existing in all types of channels or conduits and an average rainfall-runoff relation. The variable factors were evaluated for application in the vicinity of Washington, D.C.

1444. Soil and Water Conservation Research Division. SOIL AND WATER CONSERVATION RESEARCH IN THE GREAT PLAINS STATES. U.S. Dept. Agr., Agr. Res. Serv. Misc. P. 902, 28 pp. 1962. 1 Ag84M

Conservation, efficient use, and management of available moisture supplies for plant growth on cropland and grassland are major problems in the Great Plains. In much of the southern Plains, moisture conservation and soil blowing as a result of limited rainfall are closely related. In the eastern half of the Great Plains, water erosion continues to be one of the very difficult conservation problems.

The solution of soil and water conservation problems requires an intensive field experimental and investigational program supported by adequate laboratory and greenhouse research. From this research, practices were developed that can be applied to the land to conserve our resources.

A few examples of recent soil and water conservation research in the Great Plains area were described and illustrated.

1445. Soil and Water Conservation Research Division. SOIL AND WATER CONSERVATION RESEARCH IN THE PACIFIC NORTHWEST. U.S. Dept. Agr., Agr. Res. Serv. Misc. P. 923, 31 pp. 1963. 1 Ag84M

An illustrated report was given on soil and water conservation research in the Pacific Northwest.

1446. Sribyni, M. F. GEOMORPHOLOGICAL CHARACTERISTICS OF CATCHMENT BASINS (DRAINAGE AREAS). In PROBLEMS OF RIVER RUNOFF CONTROL. Translated from Russian. OTS 61-11431 6: 129-145. 1961. 290.9 Ak1Ae

A report was given on the characteristics of drainage areas in the U.S.S.R. for a study of flood control.

1447. Stafford, I. B., and Ward, A. D. BUFFALO CREEK FIRST OF 11 EARLY FLOOD PREVENTION PROJECTS DONE. Soil Conserv. 29(9): 197-199. 1964. 1.6 So35

A report was given on the work accomplishments of the Buffalo Creek Flood Prevention Project in New York.

1448. Staff Writer. CORPS URGES MORE FLOOD SPENDING. Engin. News - Record. 165(21): 26. Nov. 24, 1960. 290.8 En34

An $11.5-billion, 20-year program of flood-control construction was proposed by the Corps of Engineers in a study report.

Increasing the current $300-million-a-year appropriation for flood control exclusive of multiple-purpose projects to $500 million by 1970 and holding it at least that high through 1980 would finance the needed works.

The Engineers estimate that losses for major U.S. flood areas will climb to $960 million a year by 1980 if no additions are made to the flood-control system now in operation. Average annual losses now total about $700 million.

1449. Stol, P. T. GROUND-WATER LEVELS IN THE NETHERLANDS UNDER DRY AND WET CLIMATOLOGICAL CIRCUMSTANCES. (Du) Landbk. Tijdschr. 72(18): 744-755. map. Oct. 1960. 105.2 Or3
English summary.

A report was given on the ground water levels in the Netherlands of drained and undrained lands during wet and dry years.

1450. Strom, H. G. RIVER IMPROVEMENT AND DRAINAGE IN AUSTRALIA AND NEW ZEALAND. Rev. Ed. Victoria, N.Z. State Rivers and Water Supply Comn., 378 pp. maps. Ref. 1962. 290 St84

A description was given of the river improvements and drainage in Australia and New Zealand. Information was given on flood control, soil erosion control, conservation, and drainage districts.

1451. Sutton, H. P. REPUBLICAN RIVER DRAINAGE BASIN. U.S. Mo. Basin Inter-Agency Comt. Minutes Mtg. 99(app. I). 2 pp. 1958. 173 M69

A report was given on the plan for the development of the upper Republican River Drainage basin for flood control, irrigation, recreation, and wildlife for Nebraska.

1452. Terra, G. J. A. AGRICULTURAL DEVELOPMENT IN THE ANGAW BASIN, LOWER VOLTA FLOOD PLAINS GHANA. (Du) Landbk. Tijdschr. 73(21): 1100-1106. map. Dec. 1961. 105.2 Or3

1453. Thompson, J. C., and Elliott, E. W. CONSERVATION OF WATER BY CHANNELIZATION AND DRAINAGE OF PHREATOPHYTE AREAS. (Abs.) Amer. Geophysical Union Trans. 38(3): 420. June 1957. 330.9 Am3

An abstract was given on the conservation of water by channelization, and drainage of phreatophyte areas in New Mexico.

1454. Tison, L. J. HYDROLOGY AND SALINITY OF GROUNDWATERS. (Fr) United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 25-36. Ref. 1961. 278.9 Un3
English summary.

The dissolved matter in ground water was discussed as to how it affects salinity due to evaporation and irrigation. The sea water infiltration was also discussed.

1455. Todd, D. K. GROUND WATER HYDROLOGY. John Wiley and Sons, Inc. 336 pp. Ref. 1959. 292 T56

The fundamentals of ground water hydrology were given.

1456. Toth, J. A THEORETICAL ANALYSIS OF GROUNDWATER FLOW IN SMALL DRAINAGE BASINS. J. Geophysical Res. 68(16): 4795-4812. Aug. 15, 1963. 470 J823

Theoretically, three types of flow systems may occur in a small basin: local, intermediate, and regional. The local systems are separated by subvertical boundaries, and the systems of different order are separated by subhorizontal boundaries. The higher the topographic relief, the greater is the importance of the local systems. The flow lines of large unconfined flow systems do not cross major topographic features. Stagnant bodies of ground water occur at points where flow systems meet or branch. Recharge and discharge areas alternate; thus only part of the basin will contribute to the baseflow of its main stream. Motion of ground water is sluggish or nil under extended flat areas, with little chance of the water being freshened. Water level fluctuations decrease with depth, and only a small percentage of the total volume of the ground water in the basin participates in the hydrologic cycle.

1457. Tukamoto, Y. HYDROLOGIC CHARACTERISTICS OF HIGASHIYAMA WATERSHED WITH SPECIAL REFERENCE TO CHANNEL-PRECIPITATION RUNOFF. (Ja) Tokyo U. Forests Misc. Inform. 13: 99-106. map. June 1960. 99.9 T572
English summary.

A discussion was given on the channel-precipitation runoff in the Higashiyama watershed in Japan.

1458. Tuttle, J. GROUND WATER DEVELOPMENT IN THE ARID WESTERN UNITED STATES WITH SPECIAL REFERENCE TO SALT LAKE COUNTY CONDITIONS. Utah Econ. and Business Rev. 19(7): 2-5. July 1959. 280.8 Ut1

A report was given on the ground water development in arid Western United States. Special reference was made to conditions in Salt Lake County in Utah.

1459. Tyson, H. N., Jr., and Weber, E. M. GROUND-WATER MANAGEMENT FOR THE NATION'S FUTURE—COMPUTER SIMULATION OF GROUND-WATER BASINS. J. Hydraul. Div., ASCE 90(HY 4): 59-77. 1964. 290.9 Am3Ps

A mathematical model of a ground water basin, representing its storage and transmissive characteristics, was developed and tested using general purpose analog and digital computers. The model permitted water level elevations within the basin to be predicted, particularly in response to extraction and recharge activities carried out under a program of planned use and basin management. Large amounts of geologic and hydrologic data were collected, analyzed, and reduced for use in the computer simulation. A suitably simplified model of an aquifer system was developed that led to the diffusion equation in two dimensions. This diffusion model was approximated by a system of difference-differential equations defined by a set of asymmetrically-spaced node points. The procedure developed for ground water basin analysis was extended to handle certain nonlinear features.

1460. Uhlig, H. G. MINNESOTA FARMERS DEVELOP WATER FOR RECREATION AND WILDLIFE. Soil Conserv. 29(3): 65-66. 1963. 1.6 So3S

A report was given on the recreation and wildlife use of the pits and ponds in Minnesota designed originally for flood control, erosion control, and for livestock watering use.

1461. U.S. Bureau of Reclamation. GROUND-WATER MOVEMENT. Denver, 1964. (Engin. Monog. No. 31) 67 pp. 1964. 156.85 G91

Formulas were described that apply to certain important causes of ground water movement. Analyses were given of a variety of ground water problems encountered in the planning and development of the Bureau of Reclamation water resources projects in the Western United States.

1462. U.S. Geological Survey. ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION UNITED STATES AND CANADA 1955-58. Prepared in cooperation with the Subcommittees on Hydrology and Sedimentation, Inter-Agency Committee on Water Resources and compiled by H. C. Riggs. U.S. Geol. Survey, Water Supply Paper 1546, 236 pp. 1962. 407 G29W

An annotated bibliography on hydrology and sedimentation was given for the United States and Canada for the period 1955-1958. Articles on many of the phases of drainage were included.

1463. U.S. Inter-Agency Committee on Water Resources. Subcommittees on Hydrology and Sedimentation. ANNOTATED BIBLIOGRAPHY ON HYDROLOGY 1951-54 AND SEDIMENTATION 1950-54 (UNITED STATES AND CANADA). Amer. Geophysical Union. Inter-Agency Committee on Water Resources. Joint-Hydrol.-Sediment. B. 7, 207 pp. Dec. 1955. 173 In897N

An annotated bibliography on hydrology and sedimentation was given for the United States and Canada for the period stated. Articles on many phases of drainage were reported.

1464. U.S. Inter-Agency Committee on Water Resources. Subcommittees on Hydrology and Sedimentation. ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION 1959-1962, UNITED STATES AND CANADA. C. E. Bradberry and associates. U.S. Inter-Agency Comm. Water Resources. Joint Hydrol.-Sediment. B. 8, 323 pp. Sept. 1964. 173 In897N

An annotated bibliography on hydrology and sedimentation was given for United States and Canada for the period 1959-1962. Articles on many of the phases of drainage were included.

1465. U.S. Soil Conservation Service. ECONOMICS GUIDE FOR WATERSHED PROTECTION AND FLOOD PREVENTION. U.S. Dept. Agr., Soil Conserv. Serv. Unnumbered Rpt. Irregular pp. Mar. 1964.

This economics guide provides guidance in the use of acceptable economic evaluation procedures for evaluating watershed projects. These include projects developed under the authority of the Watershed Protection and Flood Prevention Act (P. L. 566 as amended), as well as the eleven authorized Flood Prevention watersheds.

The evaluation methods, procedures, and examples outlined were designed within the framework of existing statutory and policy requirements. Their use will tend to assure comparability of results and will facilitate review of watershed work plans.

1466. U.S. Soil Conservation Service. WATER FACTS; SOURCES, SUPPLY, NEEDS, USES, LOSSES, FLOODS, CONSERVATION. U.S. Dept. Agr. Pa-337, rev., 14 pp. May 1964. 1 Ag84Pro

A revised edition was given on water facts in the United States. A brief discussion was given on the sources, supply, needs, uses, losses, floods, drainage, and conservation.

1467. U.S. Tennessee Valley Authority Library. FLOOD DAMAGE PREVENTION; AN INDEXED BIBLIOGRAPHY. Knoxville, Tenn., 1963. 28 pp. 1963. 241.4 Un39

A bibliography was given on articles written on flood damage prevention.

1468. Uppal, H. L., Singh, G., and Singh, R. GROUND-WATER RESOURCES OF BARI DOAB TRACT. Internatl. Comn. Irrig. and Drain. Annu. B. 1964: 21-38. map. 1964. 55.9 In8A

A report was given on the ground water resources of the Bari Doab Tract in India and the irrigation and drainage development in the area.

1469. Valantine, V. E. GROUND-WATER MANAGEMENT FOR THE NATION'S FUTURE—EFFECTING OPTIMUM GROUND-WATER BASIN MANAGEMENT. J. Hydraul. Div., ASCE 90(HY 4): 97-105. 1964. 290.9 Am3Ps

The most economical plan for coordinating the construction and operation of surface and ground water basin systems must be developed with the assumption that any legal obstacles may be overcome and that the necessary management organization will be available. In implementing an optimum plan, however, the problems imposed by these assumptions must be resolved. The legal and management limitations imposed by existing rights to extract ground waters, and the fragmentation of the water service to lands overlying a ground water basin by many producing and distributing agencies and by existing water supply systems were examined. Procedures for overcoming these limitations and achieving the unified and coordinated operation of ground water surface water systems were investigated, and a recommended solution was presented.

1470. Valken, K. F. THE SITUATION OF DELTA OPERATIONS. (Du) Nederland. Heidemaatsch. Tijdschr. 69(10): 248-253. maps. Oct. 1958. 12 N282

1471. Vanzetti, C. ECONOMY AND FINANCING OF IRRIGATION, DRAINAGE AND FLOOD CONTROL. Cong. Irrig. and Drain. Trans. 5(3): R.15.627-R.15.650. Ref. 1963. 55.9 C7652

A report was given on the economy and financing of irrigation, drainage, and flood control in Italy.

1472. Varennes-E-Mendonca, P. De. PROFESSOR RUY MAYER AND THE TEACHING OF FOREST HYDRAULICS. (Por) Agros (Lisboa) 41(1): 21-25. Jan./Feb. 1958. 15.5 Ag82

1473. Verme, L. D. THE REGULATION OF MOUNTAIN BASINS CAN REDUCE FLOOD DAMAGE. (It) B. Agr. [Milano] 98(24): 1-2. Nov. 27, 1964. 16 B87

1474. Vernisse, J. AGRICULTURAL UTILIZATION OF THE RHARB PLAINS. (Fr) (Extr.) Terre Marocaine. 31(329): 123-129. Apr. 1957. 24 T44

1475. Vladychenskii, S. A. EFFECT OF WATER RESERVOIRS ON SOILS. (Rus) Pochvovedenie. 1958(9): 70-79. Ref. Sept. 1958. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 9: 1006-1012. Ref. Sept. 1958. 57.8 P34Ae

The influence of water storage reservoirs on ground water level and soil formation was described for Russia.

The influence of storage reservoirs on soil was divided into the following four zones: (1) Periodic flooding zone; (2) boggy zone; (3) a zone where meadow formation is taking place; and (4) the zone of gleying of soils at lower horizons. Soil properties were worse in the first two zones.

1476. Vogel, H. D. NEW APPROACH TO LOCAL FLOOD PROBLEMS. J. Hydraul. Div., ASCE 86(HY 1): 53-61. Jan. 1960. 290.9 Am3Ps

The growing pressures of population and urban growth tending to increase encroachment on the flood plain, thereby increasing flood damage potential were discussed. TVA experience in indentifying flood-danger areas of cities and encouraging local action to guide urban development away from these areas were reviewed.

1477. Volker, A. PEOPLES OF DELTAS, A SEE-SAW BATTLE BETWEEN RIVER AND SEA. UNESCO Cour. 17 (7/8): 44-47. July/Aug. 1964. 280.8 Un393

A discussion was given of the see-saw battle between river and sea for the people living on the deltas throughout the world.

1478. Volkovskii, P. A., Ksenofontova, V. V., and Ivanov, S. Y. METHODS OF RECLAMATION AND AGRICULTURAL UTILIZATION OF LANDS IN FLOOD-PLAIN OF THE MOSKVA RIVER. (Rus) Gidrotekh. i Melior. 2: 47-55. map. Feb. 1964. 290.8 G362

1479. Walton, W. C., and Prickett, T. A. HYDROGEOLOGIC ELECTRIC ANALOG COMPUTERS. J. Hydraul. Div., ASCE 89(HY 6): 67-91. Nov. 1963. 290.9 Am3Ps

Electric analog computers are versatile and simple equipment that allow ground water development schemes to be rapidly and accurately tested and allow the relative merits of alternate choices of development to be appraised. The electric analog computer consists of an analog model and excitation-response apparatus, i.e., waveform generator, pulse generator, and oscilloscope. The analog model is a regular array of resistors and capacitors whose values vary in accordance with the irregular physical dimensions and properties of nonhomogeneous aquifers.

1480. Ward, R. C. THE EFFECT OF SITE FACTORS ON WATER-TABLE FLUCTUATIONS. J. Hydrol. 1(2): 151-165. 1963. 292.8 J82

Some of the factors affecting the daily fluctuations of a shallow water table were discussed. The derivation was described of a fluctuation ratio which either minimizes or entirely obviates the effects of climatological factors on water-table movement and which therefore facilitates the comparison of water-table movement in different wells.

1481. Water Committee. AN INVENTORY OF INFORMATION ON FEDERAL WATER RESEARCH ACTIVITIES AND FACILITIES. Denver Fed. Exec. Board (Unnumbered Rpt.) May 1964.

General information was provided about Federal water research activities in Western United States being carried on by the Agriculture Research Service and Forest Service of the U.S. Department of Agriculture; the Public Health Service of the U.S. Department of Health, Education, and Welfare; and the Bureau of Reclamation and Geological Survey of the U.S. Department of the Interior. The information given includes the project title, location, objective of research, project leader and key personnel, official name of facilities, functional purpose and/or capability of facilities, location, and type of and/or description of unusual or special purpose equipment. The specific areas of research are in the general categories of hydraulics, hydrology, agriculture, biology, irrigation, ecology, economics, chemistry, physics, nuclear physics, meteorology, civil engineering, soils, geology, drainage, electric power, botany, soil and water conservation and management, forestry, and fish and wildlife. The geographical area in which the research is being conducted is in Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, South Dakota, Utah, and Wyoming.

1482. Weinkauff, H. C. C. USE OF LONGITUDINAL EMBANKMENTS OR LEVEES AS FLOOD PROTECTION MEASURES. Cong. Irrig. and Drain. Trans. 4(5): G14.1-G14.21. 1960. 55.9 C7652

A discussion was given on the advantages and disadvantages of using levees as flood protection measures. A brief discussion was given of each of the 24 papers on the subject that was presented at the meeting.

1483. Weinkauff, H. C. C. ECONOMIC ECALUATION AND FINANCING OF FLOOD CONTROL WORKS IN THE UNITED STATES. Cong. Irrig. and Drain. Trans. 5(2): R.15.31-R.15.49. 1963. 55.9 C7652

A discussion was given of the basic principles and general procedures of evaluation of flood damages and flood control benefits in the United States. The nature of the benefit-cost ratio and its use in decision-making were discussed with relation to the intangible factors of risk, uncertainty, and judgment.

1484. Werner, P. W. SOME PROBLEMS IN NON-ARTESIAN GROUND-WATER FLOW. Amer. Geophysical Union Trans. 38: 511-518. 1957. 330.9 Am3

Problems relating to ground-water movement in aquifers under water-table conditions and with the unsteady flow caused by variations in some boundary condition or in the replenishment from the ground surface were discussed. The cases treated were: (1) The flow between two reservoirs; and (2) the flow between a water divide and a reservoir.

1485. White, E. M. DRAINAGE ALIGNMENT IN WESTERN SOUTH DAKOTA. Amer. J. Sci. 259: 207-210. 1961. 470 Am34

Northwest-southeast stream alignment in western South Dakota coincides with the prevailing wind direction. This alignment appears to be due to the periodic accumulation of locally derived eolian sediments in drains which are not aligned. Because of this deposition, unaligned drains are not elongated by water erosion as rapidly as those which are aligned. Eolian sediment can be derived locally and deposited when the prairie vegetation is destroyed by fire or weakened by drought.

1486. White, G. F. STRATEGIC ASPECTS OF URBAN FLOOD PLAIN OCCUPANCE. J. Hydraul. Div., ASCE 86(HY 2): 89-102. Feb. 1960. 290.9 Am3Ps

A striking feature of national efforts at flood control in the United States is that in the more than two decades since a national policy was launched in 1936, the mean annual toll of flood losses has continued to rise. While at least 4 billion dollars have been spent for engineering works to reduce and control floods, the economic losses from occasional flood disaster have mounted. To understand this paradox it is necessary to examine what has been happening in the human occupance of flood plains.

This paper outlines briefly the broad problem of flood-loss reduction in the United States, reviews the findings from a recent study of changes in urban occupance of flood plains, and then suggests three strategic aspects of such occupance that seem likely to affect the results of any further engineering efforts at flood control.

1487. Wijk, W. R. Van. SIMPLE MODELS FOR DEMONSTRATION OF FLOW OF GROUND-WATER. Netherlands J. Agr. Sci. 5(3): 176-179. Aug. 1957. 12 N3892

A simple model for demonstration of flow of ground water (for drainage) was described and illustrated that allows quick changing from one flow pattern to another. The models are used in the same ways as lantern slides. In a quick succession, flow patterns are projected on a screen during a classroom lecture.

1488. Williams, D. A. WATERSHEDS—NATURAL UNITS FOR CONSERVATION PROGRAMS. Soil Conserv. 26(9): 195. Apr. 1961. 1.6 So3S

A report was given on the use of watersheds for flood control and multi-purpose conservation projects.

1489. Williams, H. R. ARKANSAS WATERSHED TEAM SPEEDS FLOOD PREVENTION AND RECREATION. Soil Conserv. 29(9): 205-206. 1964. 1.6 So3S

A report was given on the development of the Flat Creek watershed project in Arkansas for flood control and recreation.

1490. Wilson, J. N. THE SRI MENANTI, SENGGARANG AND MUAR DRAINAGE SCHEMES, JOHORE. Malayan Agr. J. 40(4): 241-252. maps. 1957. 22.5 F312

A discussion was given on some drainage and flood control schemes in Malaya.

1491. Wilson, N. W. IN VIRGINIA FLOOD PREVENTION PROJECTS—NEW RESERVOIRS PROVIDE RECREATION. Va. Wildlife. 21(8): 6-7. 1960. 410 V81

The South River Watershed Project, though only half finished, has provided Waynesboro and surrounding Augusta County new recreation areas as well as flood protection.

Eleven of the 17 planned flood dams have been built. They control flood runoff from 22 percent of the 92,000-acre watershed.

1492. Wisler, C. O., and Brater, E. F. HYDROLOGY. Ed. 2. John Wiley and Sons, Inc., N.Y. 408 pp. 1959. 292 W752

A revised second edition textbook was given for college and university use. The book should be valuable for all persons interested in the various phases of hydrology.

1493. Work, R. A., and Shannon, W. G. SNOW SURVEY REPORTS HELP WEST IN YEARS OF FLOODS OR DROUGHT. Soil Conserv. 29(9): 213-215. 1964. 1.6 So3S

A report was given on the values of snow surveys in Western United States for forecasting of floods and droughts.

1494. Wu, I-P. DESIGN HYDROGRAPHS FOR SMALL WATERSHEDS IN INDIANA. J. Hydraul Div., ASCE 89(HY 6): 35-66. Nov. 1963. 290.9 Am3Ps

The results of a hydrography study of small watersheds in Indiana were given to determine the shape of the hydrograph and the peak discharge for use in areas where no stream gaging station is available. A mathematical expression of the hydrograph containing certain parameters that could be correlated with identifiable and readily obtainable watershed characteristics provided the theoretical basis for establishing the synthetic hydrograph.

1495. Yamaguchi, I. FUNDAMENTAL STUDIES ON THE GROUND WATER FLOW PHENOMENA AT THE WATER SOURCE ZONE. (Ja) Tokyo U. Forests B. 58: 133-285. map. Ref. Dec. 1963. 99.9 T57
English summary.

Fundamental studies were reported on the ground water flow phenomena at the water source zone in two small watersheds in Japan.

1496. Young, G. FLOODS ARE BEING PREVENTED WATERSHED BY WATERSHED. Soil Conserv. 29(9): 195-197. 1964. 1.6 So3S

A report was given on the progress of the watershed method to control floods in the United States.

1497. Zaghloul, M. G. E. D. UNDERGROUND WATER IN THE NILE DELTA AFTER CONSTRUCTION OF THE HIGH DAM. Cong. Irrig. and Drain. Trans. 5(5): R.17.21-R.17.42. map. 1963. 55.9 C7652

A report was given on the expected water table changes in the Nile Delta in U.A.R. after completion of the high dam.

1498. Zaslavsky, D., and Kirkham, D. THE STREAMLINE FUNCTION FOR AXIALLY SYMMETRIC GROUNDWATER MOVEMENT. Soil Sci. Soc. Amer. Proc. 28(2): 156-160. 1964. 56.9 So3

The equation for the stream function for axially symmetric potential flow of ground water was derived. The equation was illustrated by obtaining the steamlines for flow into an auger hole as used for hydraulic conductivity determination of soil.

1499. Zhukovetskii, P. A. RESERVOIRS OF GROUND WATERS IN THE DISTRICTS OF VIRGIN SOIL AND WASTELAND RECLAMATION. (Rus) Leningrad, Gosudarstvennoe Izdatel'stvo Literatury po Stroitel'stvu i Arkhitekture, 1955. 108 pp. 1955. 292 Z6

SEE ALSO--12, 39, 118, 130, 143, 405, 411, 416, 444, 454, 475, 533, 547, 627, 628, 636, 642, 676, 747, 772-774, 796, 816, 826, 829, 846, 849, 851, 853, 863, 953, 960, 1005, 1006, 1065, 1082, 1115, 1116, 1136, 1158, 1500, 1507, 1510, 1533, 1534, 1541, 1542, 1554, 1556, 1559, 1560, 1562, 1564, 1569, 1570, 1574, 1581, 1586, 1588, 1599, 1600, 1616, 1617, 1622, 1632, 1639, 1642, 1646, 1647, 1649, 1650, 1660-1668, 1687, 1688, 1691, 1692, 1700, 1716, 1717, 1724, 1730, 1735, 1747, 1753, 1773-1775, 1786, 1793, 1799, 1800, 1803, 1807, 1809, 1818, 1826, 1832-1834, 1841, 1844, 1852, 1857-1859, 1865, 1866, 1873-1877, 1886, 1892, 1897, 1902, 1924, 1925, 1939, 1941, 1944, 1955, 1956, 1958, 1959, 1961, 1962, 1977, 1978, 1995, 2006, 2014, 2028, 2031, 2032, 2035, 2039, 2040, 2042, 2046, 2047, 2050, 2053, 2054, 2056-2058, 2063, 2074, 2078, 2079, 2083, 2084, 2092, 2105, 2109-2111, 2117, 2120, 2126, 2127, 2131, 2151, 2155, 2156, 2169, 2171, 2181,2203, 2207, 2208, 2216, 2220, 2229, 2231, 2242, 2247, 2248, 2250, 2261, 2291, 2295, 2299, 2305, 2318, 2319, 2332, 2333, 2335-2337, 2341, 2342, 2355, 2359, 2368, 2377, 2383, 2394, 2395, 2397, 2401, 2409, 2413, 2419, 2451, 2462, 2497, 2520, 2554, 2570, 2575, 2581, 2593, 2637, 2638, 2640, 2679, 2684, 2742, 2747, 2748, 2750, 2754, 2800, 2819, 2844, 2854, 2872, 2906, 2918, 2919, 2920, 2925, 2935, 2940, 2943, 2956, 2964, 2974, 2975, 3026, 3116, 3131, 3371, 3372, 3411, 3457, 3498-3508, 3511, 3515, 3519-3523, 3525, 3527-3531, 3543, 3546, 3548-3560, 3562, 3576, 3578, 3605, 3625, 3646, 3682,3704, 3708, 3710, 3722, 3724, 3730, 3753, 3827, 2830, 2834, 3836, 3859, 3862, 3890, 3930, 3933, 3935, 3938, 3955, 3970, 3976, 3978, 3980, 3988, 3995, 3997, 4005, 4034, 4061, 4066, 4168, 4269, 4276, 4362, 4412, 4459, 4501, 4518, 4579, 4862, 4972, 5035, 5065, 5067, 5098, 5118.

Soil Mechanics and Hydraulics

1500. Amer, A. V. CALCULATION OF RIVER-BANK DRAINAGE FOR THE CONTROL OF UNDERFLOODING OF IRRIGATED LANDS. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 51: 226-231. 1963. 106 P44
English summary.

The problem of seepage flow through porous soil toward cut off drains was studied for the Nile Valley (U.A.R.).

1501. Astapov, S. V. AMELIORATIVE PEDOLOGY. (LABORATORY MANUAL). Ed. 2. OTS 64-11013. 272 pp. 1964. 56.43 As8Ae

An English translation was given of the second edition of the laboratory manual on ameliorative pedology that was originally published in Russian. This book was written to enable students to master the most important methods of assessing the hydrological, physical, and chemical properties of soils from their improvements.

1502. Ayers, H. D. ENGINEERING PROBLEMS IN THE EXPLOITATION OF ORGANIC TERRAIN FOR AGRICULTURAL RECLAMATION. Natl. Res. Council Canada Assoc. Comt. Soil and Snow Mech. Tech. Memo 81: 244-253. Apr. 1964. 290.9 N216

A report was given on the engineering problems of drainage and water control of organic soils.

1503. Barrios, J., and Luthin, J. N. EFFECT OF HORIZONTAL DRAINS AND CUTOFF WALLS ON SEEPAGE FLOW, UPLIFT PRESSURE, AND EXIT GRADIENT UNDER DAMS. Trans. ASAE 3(2): 95-98. 1960. 290.9 Am32T

A report was given on the effect of horizonal drains and cutoff walls on seepage flow, uplift pressure, and exit gradient under dams.

1504. Bishop, A. W., and Henkel, D. J. THE MEASUREMENT OF SOIL PROPERTIES IN THE TRIAXIAL TEST. Edward Arnold (Pub.) Ltd., 190 pp. 1957. 56.43 B542

Standard tests and special tests were discussed for the measurement of soil properties by the triaxial test.

1505. Bishop, A. W., and Henkel, D. J. THE MEASUREMENT OF SOIL PROPERTIES IN THE TRIAXIAL TEST. Ed. 2. Edward Arnold (Pub.) Ltd., 227 pp. 1962. 56.43 B542

A second edition of a book was given on standard and special tests for the measurement of soil properties by the triaxial tests.

1506. Bjerrum, L., Casagrande, A., Peck, R. B., and Skempton, A. W. FROM THEORY TO PRACTICE IN SOIL MECHANICS: SELECTIONS FROM THE WRITINGS OF KARL TERZAGHI. Wiley. 425 pp. 1960. 290 T27F

A report was given on the life and achievements of Karl Terzaghi along with some of his selected papers, reports, and a selection of bibliography of his writings on soil mechanics.

1507. Blaisdell, F. W. THE ST. ANTHONY FALLS HYDRAULIC LABORATORY. Soil Conserv. 26(12): 280-282. July 1961. 1.6 So3S

The work of the St. Anthony Falls Hydraulic Laboratory in Minnesota was described. Research on drainage equipment was mentioned.

1508. Bouwer, H. VARIABLE HEAD TECHNIQUE FOR SEEPAGE METERS. J. Irrig. and Drain., ASCE 87(IR 1, 2775): 31-44. Ref. Mar. 1961. 290.9 Am3Ps

A technique was proposed for measuring canal or reservoir seepage losses with seepage meters. The method furnishes information regarding hydraulic conductivity of bottom material and seepage gradients. A resistance network analog was used for analysis of pertinent factors and flow components, and for obtaining examples to illustrate the method.

1509. Bouwer, H. VARIABLE HEAD TECHNIQUE FOR SEEPAGE METERS. Amer. Soc. Civil Engin. Trans. 127(3): 434-447. 1962. 290.9 Am3

A technique for measuring canal or reservoir seepage losses with seepage meters was proposed. The method furnishes information regarding hydraulic conductivity of bottom material and seepage gradients. A resistance network analog was used for analyses of pertinent factors and flow components, and for obtaining examples to illustrate the method.

1510. Bouwer, H. UNSATURATED FLOW IN GROUND-WATER HYDRAULICS. J. Hydraul. Div., ASCE 90(HY 5): 124-144. Sept. 1964. 290.9 Am3Ps

A detailed discussion was given on unsaturated flow in ground water hydraulics. Various methods were examined for determining hydraulic conductivity relationships on the negative pressure side of the water table. Curves relating hydraulic conductivity to negative soil-water pressures were shown for 28 soils.

1511. Bouwer, H. THEORY OF SEEPAGE FLOW SYSTEMS. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 52-56. Jan. 1965. A56.9 R31 Discussion, pp. 64-67.

A talk and the discussion were given on the theory of seepage flow systems from canals.

1512. Bouwer, H. APPLICATION OF SEEPAGE METERS. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 77-81. Jan. 1965. A56.9 R31

A report was given on the use of seepage meters for measuring local seepage rates in canals and ponds.

1513. Bouwer, H., Meyers, L. E., and Rice, R. C. EFFECT OF VELOCITY ON SEEPAGE AND ITS MEASUREMENT. J. Irrig. and Drain. Div., ASCE 88(IR 3): 1-14. Sept. 1962. 290.9 Am3Ps

The direct effect of velocity in a canal on seepage rates and the effect of the velocity pattern distortion around a seepage-meter bell on the local head environment of the bell were studied in a laboratory flume.

1514. Bouwer, H., and Rice, R. C. SEEPAGE METERS IN SEEPAGE AND RECHARGE STUDIES. J. Irrig. and Drain. Div., ASCE 89(IR 1, proc. paper 3448): 17-42. Mar. 1963. 290.9 Am3Ps

A falling-head theory and field procedures were presented for measuring seepage and hydraulic conductivity of bottom materials in canals or ponds with seepage meters. Manometer techniques were used for measuring falling head. Examples were presented showing the application of the technique to the investigations of seepage and recharge, and in field evaluation of artifical sealants for reducing seepage.

1515. Bouwer, H., and Rice, R. C. SEEPAGE METERS. In SEEPAGE AND RECHARGE STUDIES. Amer. Soc. Civil Engin. Trans. 129: 243-245. 1964. 290.9 Am3

A digest was given on an article describing the use of seepage meters in seepage and recharge studies. The original article was published in J. Irrig. and Drain. Div., ASAE 89(IR 1): 17-42. Mar. 1963.

1516. British National Society. PORE PRESSURE AND SUCTION IN SOILS. Butterworth and Co. 151 pp. 1961. 56.09 In8

The papers were given that were presented at the conference organized by the British National Society of the International Society of Soil Mechanics and Foundation Engineering at the Institute of Civil Engineers held on March 30-31. 1960.

1517. Brooks, R. H., and Corey, A. T. HYDRAULIC PROPERTIES OF POROUS MEDIA. Colo. State U. Hydrol. Ser. Paper No. 3, 27 pp. illus. Mar. 1964.

Following the Burdine approach, a theory was presented that develops the functional relationships among saturation pressure difference, and the permeabilities of air and liquid in terms of hydraulic properties of partially saturated porous media. Procedures for determining these hydraulic properties from capability pressure-desaturation curves were described.

1518. Brooks, R. H., and Corey, A. T. HYDRAULIC PROPERTIES OF POROUS MEDIA AND THEIR RELATION TO DRAINAGE DESIGN. Trans. ASAE 7(1): 26-28. 1964. 290.9 Am32T

Some hydraulic properties of soil were described that are pertinent to drainage problems involving both the partially and completely saturated regions of the soil profile.

1519. Burykin, A. M. SEEPAGE OF WATER FROM SOILS IN MOUNTAINOUS REGIONS OF THE HUMID SUBTROPICS. (OTS 60-21877) Transl. 12339. 13 pp. Ref. 1957.
Translation from Pochvovedenie. 1957(12): 90-97. 1957.

A report was given on the seepage of water from soils in mountainous regions of the humid subtropics of the U.S.S.R.

1520. Cannell, G. H., and Stolzy, L. H. HYDRAULIC GRADIENTS ASSOCIATED WITH INFILTRATION IN FIELD STUDIES. Soil Sci. Soc. Amer. Proc. 26(2): 112-115. Mar./Apr. 1962. 56.9 So3

A field method was described for measuring hydraulic head changes with time during infiltration of water into the soil.

1521. Capper, P. L., and Cassie, W. F. MECHANICS OF ENGINEERING SOILS. Ed. 3. E. and F. Spon., Ltd., Sci. and Tech. Pub., London, England. 315 pp. 1960.

A revised edition was given of an English book on the mechanics of engineering soils.

1522. Carlier. AGRICULTURAL INTERESTS IN THE SIXTH MEETING OF HYDRAULICS (NANCY, JUNE-JULY, 1960). (Fr) Acad. d'Agr. de France. Compt. Rend. 46(14): 793-802. 1960. 14 P215Bc

1523. Carlier. SOME CURRENT PROBLEMS OF AGRICULTURAL HYDRAULICS. (Fr) Cahiers des Ingen. Agron. 173: 16-19. Feb. 1963. 14 C112

1524. Carter, R. W., and Anderson, I. E. ACCURACY OF CURRENT METER MEASUREMENTS. Amer. Soc. Civil Engin. Trans. 129: 668-669. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a study on the accuracy of current meter measurements. The original article was published in the J. Hydraul. Div., ASCE 89(HY 4): 105-115, July, 1963. References to the discussions and closure were listed.

1525. Cedergren, H. R. SEEPAGE REQUIREMENTS OF FILTERS AND PERVIOUS BASES. Amer. Soc. Civil Engin. Trans. 127(1): 1090-1108. 1962. 290.9 Am3

The water-removing capabilities of two common but distinctly different types of filter designs were analyzed by the flow-net. Typical solutions and numberical examples were presented to emphasize the importance of boundary conditions and permeability upon water-removing capacity.

With discussion by Messrs. W. J. Turnbull; Edward S. Barber; H. J. Gibbs; and Harry R. Cedergren.

1526. Cook, P. M. CONSOLIDATION CHARACTERISTICS OF ORGANIC SOILS. Natl. Res. Council, Canada Assoc. Comt. Soil and Snow Mech. Tech. Memo. 1956(41): 82-87. Oct. 290.9 N216

A compilation of test data was given that showed a relation existing between the coefficient of compressibility and moisture content over a wide range of soils, from pure peat to organic clay silts. Other parts showed the relationship between moisture contents and the following soil properties: Specific gravity, void ratio, and submerged weight.

These simple relationships were sufficient to permit the calculation of settlement without the trouble of lengthy consolidation tests.

1527. Coyle, J. J. FARM SEEPAGE PROBLEMS IN PONDS AND SMALL IRRIGATION RESERVOIRS. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 1-9. Jan. 1965. A56.9 R31

Water loss from farm ponds and small irrigation reservoirs by seepage is a serious problem in about 63 of the 156 Major Land Resources Areas in the 48 conterminous States. The extent of loss in problem sites requires some kind of lining or sealing for proper functioning of the structure. The principal causes of seepages were given along with some recommended methods of treatments.

1528. Criddle, W. D. REDUCING WATER LOSSES FROM STORAGE AND CONVEYANCE. Natl. Water Res. Symp. Proc. 1961: 139-146. 1961. 292.9 N214

A report was given on the needs and ways to reduce water losses from storage and conveyances in the United States.

Water losses of consumptive waste occurs in: (1) Natural stream channels; (2) storage reservoirs; (3) from canals, laterals, and ditches; and from the irrigated farm or other uses.

1529. Curry, R. B., and Beasley, R. P. FLOW OF COLLOIDAL SUSPENSIONS THROUGH POROUS MEDIA AS RELATED TO RESERVOIR SEALING. Trans. ASAE 5(2): 160-164. Ref. 1962. 290.9 Am32T

The flow of colloidal suspensions through porous media was investigated in order to establish some basic relationships for reservoir sealing. The scope of the study was limited to the use of granular carborundum as the media, de-aired double-distilled water, and suspensions of bentonite and double-distilled water.

1530. Decker, R. S. SOIL MECHANICS TESTS GUIDE DESIGN OF EARTH STRUCTURES IN CONSERVATION. Soil Conserv. 29(11): 247-248. June 1964. 1.6 So3S

A report was given on the soil mechanics tests used by the Soil Conservation Service to design earth structure for soil conservation practices.

1531. DeWiest, R. J. M. FREE SURFACE FLOW IN HOMOGENEOUS POROUS MEDIUM. Amer. Soc. Civil Engin. Trans. 127(1): 1045-1084. 1962. 290.9 Am3

The damping of the unsteady flow through a dam or levee with horizontal underdrain, when the head behind it is raised considerably, is treated analytically and tested in a Hele-Shaw model. Slow and rapid rises from low level to final full level were considered. Numerical examples were

included. The analytical and experimental results compared reasonably well.
With discussion by Messrs. Daniel Dicker; and Roger J. M. DeWiest. pp. 1085-1089.

1532. Durand, J. H. THE BRANCH OF PEDOLOGY OF THE HYDRAULIC AND RURAL EQUIPMENT DIRECTIONS. (Fr) Algeria Serv. des Etudes Sci. Hors Ser. 2, 26 pp. 1956. 56.9 AL32H

1533. Fonseca, V. F. D. STUDY TRIP TO ISRAEL; AGRICULTURAL ASPECTS AND AGRICULTURAL HYDRAULICS. (Por) Gaz. do Agr. 12(130): 67-82. maps. (Cont.) Mar. 1960. 24 G25

1534. Frevert, R. K., Schwab, G. O., Edminister, T. W., and Barnes, K. K. SOIL AND WATER CONSERVATION ENGINEERING. John Wiley and Sons, Inc., N.Y. 479 pp. 1955.

A professional text was given for agricultural engineering students. Subject matter on the five engineering phases of soil and water conservation was included as well as on hydrology and soil physics.

1535. Gondaira, S., Yamamoto, S., and Dokoshi, J. ON THE SEEPAGE OF EARTH DAM. (Ja) Hokkaido U. Fac. Agr. Mem. 3(2): 252-274. maps. 1959. 107.6 H682
English summary.

A report was given of the seepage through an earth dam in Japan.

1536. Gossuin, E. CURRENT PROBLEMS OF AGRICULTURAL HYDRAULICS. (Fr) Agricultura [Louvain] (ser. 2) 12(3): 543-550. map. Sept. 1964. 13 R32

1537. Hammad, H. Y. SEEPAGE LOSSES FROM IRRIGATION CANALS. J. Engin. Mech. Div., ASCE 85(EM 2, 1991): 31-36. Apr. 1959. 290.9 Am3Ps

The two-dimensional problem of steady seepage flow under gravity from a canal into a semi-pervious clay layer of finite thickness underlain by a freely permeable layer of sand and gravel in which the piezometric head is very near the canal water level. Two steps of conformal mapping were used and an approximation to the canal profile was adopted.

1538. Hammad, H. Y. SEEPAGE UNDER DAMS. Amer. Soc. Civil Engin. Trans. 129: 263-265. 1964. 290.9 Am3

A digest was given of a discussion of the two-dimensional problem of steady flow through sand beds under the aprons of dams. The original article was published in J. Soil Mech. and Found. Div., ASCE 89(SM 4): 25-44. July, 1963.

1539. Haythornthwaite, R. M. MECHANICS OF THE TRIAXIAL TEST FOR SOILS. J. Soil Mechanics and Found. Div., ASCE 86(SM 5): 35-62. 1960. 290.9 Am3Ps

The triaxial test was analyzed against the background of plastic theory. It was shown that the equilibrium conditions and a failure criterion such as Coulomb's law were insufficient to define a unique failure load; a stress-strain relationship was also needed. The problem was then solved completely for an ideally plastic material. The results were used to discuss the significance of test data for sands and an alternative yield criterion was suggested on the basis of the test data.

1540. Hosoyamada, K. STUDIES ON THE STEADY SEEPAGE FLOW WITH FREE SURFACE OBTAINED FROM THE ITERATION METHOD. (Ja) Saga U. Agr. B. 18: 95-112. Jan. 1964. 107.6 Sa13
English summary.

Studies in Japan were reported on the steady seepage flow with free surface on dikes obtained by the iteration methods.

1541. Hough, B. K. BASIC SOILS ENGINEERING. The Ronald Press. 513 pp. 1957. 290 H812

A textbook was given on basic soils engineering.

1542. Hsueh, K. Y. A NOTE OF HYDRAULICS OF SEDIMENT-BEARING CANALS AND RIVERS. (Ch) Taiwan Water Conserv. (ser. 11) 3(43): 1-6. Sept. 1963. 292.8 T13
English summary.

A note was given on the hydraulics of sediment-bearing canals and rivers in China.

1543. Jumikis, A. R. SOIL MECHANICS. D. Van Nostrand Co., Inc., 791 pp. Ref. 1962. 290 J95

A textbook was given for a beginning study of soil mechanics in colleges.

1544. Jumikis, A. R. MECHANICS OF SOILS. D. Van Nostrand Co., Inc., 483 pp. Ref. 1964. 290 J95M

The fundamentals of soil mechanics were given for the advanced college student.

1545. Kaltagova, M. G. CONTROL OF WATER LOSSES IN FILTRATION FROM RESERVOIRS AND IRRIGATION CANALS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury, 1955. 91 pp. Ref. 1955. 55 K123

1546. Karol, R. H. ENGINEERING PROPERTIES OF SOILS. Prentice-Hall, Inc., Englewood Cliffs, N.J. 81 pp. 1956. 56.43 K14

The techniques and procedures of performing laboratory tests on soils were given. Soil theory was presented only in those instances and to the extent that it concerned soil tests.

1547. Karol, R. H. SOILS AND SOILS ENGINEERING. Prentice-Hall, Inc., Englewood Cliffs, N.J. 194 pp. 1960. 290 K142

A discussion was given of soils and their physical properties. The latter sections deal with the methods and techniques of applying the principles of statics to the solution of typical soil engineering problems in slope stability, bearing capacity, retaining structures, and pile formations.

1548. Kassiff, G., and Zeitlen, J. G. BEHAVIOR OF PIPES BURIED IN EXPANSIVE CLAYS. J. Soil Mech. and Found. Div., ASCE 88(SM 2): 133-148. Apr. 1962. 290.9 Am3Ps

The results of a suudy of the stresses induced in pipes that were buried in the field in an expansive clay and exposed to seasonal changes, as well as irrigation were reported. Asbestos cement pipes were tested using vibrating wire strain gages to determine the stresses at various sections along both horizontal and vertical planes. Measurements of soil moisture changes and soil movements were made periodically during the investigation.

High stresses resulted in the pipe through inequalities in the lateral and vertical swelling behavior of the clay. Sometimes these stresses were greater than those caused by internal pressure. The swelling forces were strongly influenced by the effect of lateral restraint of the pipe. The bending moments caused by soil pressures were found to be magnified by the rigidity of the pipe connections.

1549. Kato, J., Mitsuta, M., and Shiraishi, H. HYDRAULIC STUDIES ON DRAINAGE GATE (FLAP GATE). I. (Ja) Agr. Engin. Soc. (Japan) Trans. 1: 44-48. Oct. 1960. 290.9 Ag8
English summary.

A report was given on hydraulic studies conducted in Japan on the drainage gate (flap gate) used for water control in land reclamation work.

1550. Kawaharada, R. ON THE SEEPAGE FLOW UNDERNEATH COFFER DAMS. (Ja) Kagoshima U. Facul. Agr. B. 1955(4): 100-110. Nov. 1955. 107.6 K114B
English summary.

A report on the seepage flow underneath Coffer Dams was given for Japan.

1551. Kawaharada, R. STUDIES ON SEEPAGE FLOW BY MEANS OF ELECTRICAL ANALOGUE METHOD. (Ja) Kagoshima U. Facul. Agr. B. 12: 1-106. Ref. Nov. 1962. 107.6 K114B
English summary.

Results were given of studies in Japan of seepage flow under dams by means of the electrical analogue method.

1552. Kikuoka, T. ON THE OBSERVATION OF SEEPAGE LINE AT TAKETANI-IKE EARTH DAM IN MIE PREFECTURE. (Ja) Mie U. Facul. Agr. B. 26: 21-29. Oct. 1962. 107.6 T78
English summary.

The seepage line observed at an earth dam in Japan was reported. The observed data were then compared with computed results for the seepage line by three different methods.

1553. Kouno, H., and Kodani, Y. STUDIES ON THE STABILIZATION OF SOIL. I. EFFECT OF THE ADMIXTURE; BENTONITE, LIME AND PEARLITE. (Ja) Tottori Soc. Agr. Sci. Trans. 16: 58-62. Nov. 1963. 513 T64
English summary.

A report was given on the use of bentonite. lime, and pearlite to stabilize soils in Japan.

1554. Kovacs, G. THE DEVELOPMENT OF WATER TABLE IN THE VICINITY OF CANALS WITH NEARLY CONSTANT WATER LEVEL. Cong. Irrig. and Drain. Trans. 5(5): R17.305-R17.328. 1963. 55.9 C7652

A study was reported on the development of a uniform hydraulic calculation system for the determination of hydraulic characteristics of the ground water situation (seeping water discharge, surface curve influenced by the canal, and long distance effect of the canal) arising in the vicinity of canals with a nearly constant level.

1555. Kuwano, S. ON THE HYDRAULICAL STUDIES OF DIKE SLUICES. IX. WIDTH OF KAWAYUKI STABILIZATION OF DIVERSION CHANNEL AND NEW DRAINAGE FORMULAS. (Ja) Nogyodoboku-Kenkyu 27(2): 66-71. July 1959. 290.8 N68
English summary.

Hydraulic studies of dike sluices in Japan were reported. The width of Kawayuki, stabilization of diversion channels, and new drainage formulas were given.

1556. Lambe, T. W. SOIL TECHNOLOGY IN SOIL ENGINEERING. Amer. Soc. Civil Engin. Trans. 126(1): 780-794. Ref. 1961. 290.9 Am3

Soil technology was defined and described. The contributions that soil technology makes to soil engineering were presented and illustrated.
With Discussion by A. A. Eremin. pp. 794.

1557. Lawler, E. A., and Druml, F. V. HYDRAULIC PROBLEM SOLUTION ON ELECTRONIC COMPUTERS. Amer. Soc. Civil Engin. 125: 517-535. 1960. 290.9 Am3

Applications on three types of electronic computers were presented demonstrating the wide range of problems readily solved by these modern tools. Tedious, cumbersome, conventional methods of solution were replaced by quicker and frequently more accurate methods, thus making more efficient use of the engineer for truly engineering problems.

1558. Leliavsky, S. IRRIGATION AND HYDRAULIC DESIGN. I. GENERAL PRINCIPLES OF HYDRAULIC DESIGN. Chapman and Hall, Ltd. 492 pp. 1955. 290 L531

A book was given on the general principles of hydraulic design. The following chapters were discussed: (1) Percolation of water as a structural design factor; (2) tail erosion; and (3) hydraulics of canals and rivers.

1559. Leliavsky, S. IRRIGATION AND HYDRAULIC DESIGN. II. IRRIGATION WORKS. Chapman and Hall, Ltd. 864 pp. 1957. 290 L531

A book was given on the design of irrigation works. The following chapters were given: (1) Design of regulators; (2) design of irrigation and drainage syphons; (3) weirs and other hydraulic works; (4) planning and designing a perennial irrigation scheme; and (5) canal bridges, aqueducts, and gates.

1560. Leliavsky, S. IRRIGATION AND HYDRAULIC DESIGN. III. HYDRAULIC STRUCTURES FOR IRRIGATION AND OTHER PURPOSES. Chapman and Hall, Ltd. 765 pp. 1960 290 L531

A book was given on the hydraulic structures for irrigation and other purposes. The following chapters were given: (1) Diversion headworks on alluvial rivers; (2) locks; (3) arches; (4) dams; and (5) electrification of irrigation works.

1561. Leonards, G. A., and Narain, J. FLEXIBILITY OF CLAY AND CRACKING OF EARTH DAMS. J. Soil Mech. and Found. Div., ASCE 89(SM 2): 47-98. Mar. 1963. 290.9 Am3Ps

An approximate theory was formulated to calculate the critical tensile strains in an earth dam as a result of differential settlements (at the base) along the axis of the dam.

Laboratory apparatus and procedures were developed in order to estimate the limiting tensile strain at which a compacted clay will crack.

Comparisons between predicted and observed behavior of four dams and one test embankment indicated that the theory and laboratory tests can be used to predict the cracking potential of an earth dam (if the settlement pattern is known) with an accuracy that was satisfactory for practical purposes.

1562. Linsley, R. K., and Franzini, J. B. WATER-RESOURCES ENGINEERING. McGraw-Hill Book Co. 654 pp. 1964. 292 L65W

A book was given on water resource engineering. Several chapters were devoted directly and indirectly to drainage.

1563. McNown, J. S., Hsu, E.-Y., and Yih, C.-S. APPLICATIONS OF THE RELAXATION TECHNIQUE IN FLUID MECHANICS. Amer. Soc. Civil Engin. Trans. 120: 650-659. 1955. 290.9 Am3

Problems in fluid mechanics of essentially irrotational flow are often so complex that numerical methods must be used in their resolution. A simple, yet generally useful method is the relaxation process, which is based on a network of values of the required function determined by means of the finite-difference theory. The numerical process is simple, and techniques are available for satisfying various types of boundary conditions. The computations are useful in solving problems of efflux and seepage and in analyzing flow through transitions or around submerged bodies. Examples of these various types have been solved, and the results were presented as illustrations of the process.

With Discussion by Messrs. Fred W. Blaisdell; Henry M. Paynter and Ronald F. Scott; Mladen Boreli; Turgut Sarpkaya; and John S. McNown, En-Yun Hsu, and Chia-Shun Yih. pp. 670-686.

1564. Marcus, H., Evenson, D. E., and Todd, D. K. SEEPAGE OF SALINE WATER IN DELTA LOWLANDS. Berkeley Hydraulic Lab. U. Calif., 1962. (Calif. U. Water Resources Cent. Contrib. No. 53) 70 pp. 1962. 292 M332

A report was given on the experimental tests in California to prevent seepage of saline water into delta lowlands.

1565. Means, R. E., and Parcher, J. V. PHYSICAL PROPERTIES OF SOILS. Charles E. Merrill Book Co. 464 pp. 1963. 56.43 M46

The basic understanding of the physical properties of soils was discussed for soil mechanics and foundation engineering.

1566. Mingazzini, C. NEED OF HYDROLOGICAL RECLAMATION IN THE APPENNINES. (It) Accad. Naz. di Agr. Ann. (ser. 3) 67: 42-45. map. 1960-61, pub. 1962. 16 B632A

1567. Moh, Z. SOIL STABILIZATION WITH CEMENT AND SODIUM ADDITIVES. J. Soil Mech. and Found. Div., ASCE 88(SM 6): 81-105. Dec. 1962. 290.9 Am3Ps

The mechanisms by which a group of alkali metal compounds improves the stability of cement or lime stabilized soils were studied. The types and trends of the interaction among the soil constituents and admixtures was studied rather than the exact chemical formulation of the final products. Mixtures of mono-mineral soils (quartz, gibbsite, and kaolinite), cementing compounds (hydrated lime, tricalcium silicate, and portland cement) and selected sodium additives (hydroxide, metasilicate, and sulfate) were examined during the curing period by a number of special analytical techniques, including X-ray diffraction, differential thermal analysis, flamephotometry, and colorimetry.

All mono-mineral soils tested reacted with the calcium stabilizers. Addition of sodium additive greatly intensified the reaction between the soil and cementing compound, and increased the abundance of reaction products.

1568. Nakaya, M. APPLIED STUDIES ON THE BENTONITE AS SOIL AND CEMENT ADMIXTURES. (Ja) Osaka. U.B. Ser. B., Agr. and Biol. 14: 61-98. Ref. 1963. 107.6 Sa23
English summary.

A report was given on the use of bentonite as soil as cement admixtures in Japan. The use of bentonite for seepage control in rice crops was discussed in one of the chapters.

1569. Ochiai, T. STUDIES ON DAM LEAKAGE. (Ja) Tokyo Natl. Inst. Agr. Sci. B. Ser. F., Agr. Engin. 1956(9): 1-39. Feb. 1956. 290.9 T57
English summary.

Investigations were made at several leaking irrigation dams in Japan by the use of radioisotopes. The authors concluded that: (1) When the leaking route was not deep, the route could be located directly from the ground surface, by measuring the intensity of radioactivity radiated from the radioisotopes injected in water; and (2) when the route was deep, it was necessary to measure the radioactivity with counters in boreholes drilled in the dam body, or that of water sampled from boreholes.

1570. Reisenauer, A. E. SOME INFLUENCES OF SOILS AND WATER TABLE DEPTHS ON SEEPAGE FROM LINED AND UNLINED CANALS. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-90: 68-75. Jan. 1965. A56.9 R31

A computer program capable of solving problems relating to multidimensional, partially saturated flow in heterogeneous soils was briefly described and used to examine rate of seepage loss from canals. Depth to the water table was shown to have an effect on seepage rate.

1571. Reynolds, H. R., and Protopapadakis, P. PRACTICAL PROBLEMS IN SOIL MECHANICS. Ed. 2 Crosby Lockwood and Sons, Ltd. 205 pp. 1956. 56.43 R33

A second edition of a book was given of the application of soil mechanics for the practicing engineer. The analyses of practical problems were given.

1572. Reynolds, H. R., and Protopapadakis, P. PRACTICAL PROBLEMS IN SOIL MECHANICS. Ed. 3. Crosby Lockwood and Sons, Ltd. 223 pp. 1959. 56.43 R33

A third edition of a book was given on the application of soil mechanics for the practicing engineer. The analyses of practical problems were given.

1573. Seed, H. B., and Chan, C. K. UNDRAINED STRENGTH OF COMPACTED CLAYS AFTER SOAKING. J. Soil Mech. and Found. Div., ASCE 85(SM 6): 31-47. Dec. 1959. 290.9 Am3Ps

Test data were presented to show that soil structure has a profound effect on a variety of soil properties including shrinkage, swell pressures, permeability, pore-water pressures induced during loading, and undrained strength. However, it was also found that soil structure appears to have little effect on soil strength characteristics expressed in terms of effective stresses, and its influence on the results of undrained strength tests on saturated specimens was therefore due essentially to its effect on the pore-water pressures developed in the samples during the testing process. Saturated samples of compacted clay having flocculated structures tended to develop substantially lower pore-water pressures at low strains in undrained tests than did samples of the same density and water contents having dispersed particle arrangements and consequently exhibit greater resistance to deformation at this stage of the test. As the strain increased, however, these initial differences in pore-water pressure tended to disappear, and specimens with different initial structures but the same dry density and water content therefore tend to have similar undrained strengths measured at high strains.

1574. Shea, P. H. UNUSUAL FOUNDATION CONDITIONS IN THE EVERGLADES. Amer. Soc. Civil Engin. Trans. 120: 92-102. 1955. 290.9 Am3

Unusual foundation conditions encountered on that part of the Central and Southern Florida Project to be built in the Everglades include: (1) Very pervious solution-riddled limestone in the foundations of water-retention works; (2) thick layers of soft peat in levee foundations; and (3) structure foundations of interbedded sand and porous limestone.

Prevention of seepage losses by grouting or cutoff walls was not economically feasible. Water-control works on the landside of the levees must be designed to include the underseepage flow. Quantitative determinations of the probable underseepage were based on permeabilities computed from the results of well-pumping tests.

1575. Soil and Water Conservation Research Division Staff. WATER CONSERVATION BY SEEPAGE CONTROL. U.S. Dept. Agr. Picture Story 143, 6 pp. 1962. 1.914 P3P58

An illustrated report was given on water conservation by seepage control.

1576. Sokolovski, V. V. STATICS OF SOIL MEDIA. Ed. 2. Butterworth Sci. Pub. 237 pp. 1960. 290 So33Ae

An English translation was given was given of a book on statics of soils media originally written in Russian.

1577. Sowers, G. B., and Sowers, G. F. INTRODUCTORY SOIL. Mech. and Found. Ed. 2. 386 pp. 1961. 56.43 So93

A revised textbook was given on introductory soil mechanics.

1578. Spangler, M. G. SOILS ENGINEERING. Ed. 2. International Textbook Co., Scranton, Pa. 483 pp. 1960.

A revised edition of a book was given on soil mechanics in action for the student and the beginner in the field.

1579. Szilagyi, G., and Vagas, I. SEEPAGE LOSSES FROM IRRIGATION EARTH CANALS. (Hu) Vizugyi Kozlem. 1: 23-44. map. Ref. 1962. 290.9 H89
English summary. pp. 7-8.

A simple method used in Hungary was described for determining the seepage losses from unlined irrigation canals.

1580. Thorfinnson, S. T. UNDERSEEPAGE CONTROL AT FORT RANDALL DAM. Amer. Soc. Civil Engin. Trans. 125: 792-806. 1960. 290.9 Am3

The relief well system installed to control underseepage beneath Fort Randall Dam was described. Data were presented on the field investigations made, the design of the wells, and the performance of the completed system.

1581. Todd, D. K., and Bear, J. SEEPAGE THROUGH LAYERED ANISOTROPIC POROUS MEDIA. Amer. Soc. Civil. Engin. 128(1): 256-283. 1963. 290.9 Am3

A summary was given of an investigation of seepage from leveed rivers in low-lying adjoining agricultural lands. Only the flow rate and distribution of seepage as a function of the surface and subsurface boundary conditions were studied. Flow nets in idealized cross sections were determined by an electric analogy model. Boundaries represented channel bed and bank, a levee base, a lower impermeable stratum, and the water table in adjoining drained agricultural land. Variables studied included two subsurface layers of different permeabilities and anisotropies, layer arrangements and thicknesses, channel depth and width, levee base width, and water table slope.

With discussion by Mr. Serge Leliavsky. pp. 283.

1582. Turnbull, W. J., and Mansur, C. I. DESIGN OF UNDERSEEPAGE CONTROL MEASURES FOR DAMS. J. Soil Mech. and Found. Div., ASCE 85(SM 5): 129-159. Oct. 1959. 290.9 Am3Ps

Methods of controlling seepage and excessive hydrostatic pressures beneath dams and levees founded on deep strata of pervious snads were presented. The principles involved in the different methods of underseepage control were also considered. Although the design of seepage control measures is not an exact science, formulas and criteria for preparing a rational design of such were given. These were based on known seepage laws, laboratory tests, and field observations.

1583. Turnbull, W. J., and Mansur, C. I. DESIGN OF CONTROL MEASURES FOR DAMS AND LEVEES. Amer. Soc. Civil Engin. Trans. 126(1): 1468-1522. 1961. 290.9 Am3

Methods of controlling seepage and excessive hydrostatic pressures underneath dams and levees founded on deep strata of pervious sands were presented. Underseepage may be controlled by three basic procedures: (1) By blocking or impeding the flow from the riverside; (2) by intercepting and safely disposing of the seepage flow; and (3) by adding weight to the landside toe to protect against uplift and increase the path of seepage. A combination of these methods may be used.

With discussion by Messrs. Marcel Bitoun and Jorgen Christiansen; H. R. Cedergren; Max Suter; Karl H. Evans; and W. J. Turnbull and C. I. Mansur. pp. 1522-1539.

1584. Turnbull, W. J., and Mansur, C. I. INVESTIGATION OF UNDERSEEPAGE—MISSISSIPPI RIVER LEVEES. Amer. Soc. Civil Engin. Trans. 126(1): 1429-1482. 1961. 290.9 Am3

The studies reported included a compilation of past underseepage reports; exploration and geological studies of numerous sites where under seepage was a serious problem in 1937; installation of piezometers at selected to measure substratum pressures; field pumping tests to determine the permeability of the sand aquifer; theoretical, model, and prototype studies of relief wells, partial cutoffs, and landside berms for controlling underseepage; and observation and measurement of natural seepage during the 1950 high water.

With discussion by Messrs. Max Suter; and W. J. Turnbull and C. I. Mansur. pp. 1482-1485.

1585. Vandertulip, J. J., McDaniels, L. L., and Walker, G. D. SEEPAGE LOSSES FROM NATURAL CHANNELS USED AS MAJOR CONVEYANCE FACILITIES. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-90: 10-18. Jan. 1965. A56.9 R31

A report was given on seepage losses from natural channels used as major conveyance facilities for multi-purpose water use projects.

1586. Veltkamp, G. W. MATHEMATICAL DESCRIPTION AND CALCULATION OF THE FLOW OF GROUND WATER. (Du) Cent. Organ. v. Toegepast-Natwetensch. Onderz. Verslagen van de Tech. Bijeenkomst 17: 10-22. 1963. 292.9 C33
English summary.

Some comments were made on the ways in which mathematics and mathematicians can help to solve technical problems concerning seepage flow of ground water in the Netherlands.

1587. Watanabe, K. STUDIES ON THE THEORETICAL ANALYSIS OF THE SEEPAGE FLOW RELATED WITH THE AGRICULTURAL WATER-STRUCTURE. (Ja) Saga U. Agr. B. 18: 1-93. Ref. Jan. 1964. 107.6 Sa13
English summary.

Studies in Japan were reported on the theoretical analysis of seepage flow from dams.

1588. Wellisch, H. A SELECTED BIBLIOGRAPHY ON FLUID MECHANICS, HYDROLOGY AND HYDRAULIC ENGINEERING, 1950-1960. Tahal Water Planning for Israel Ltd. 69 pp. 1961.

A bibliography of books and monographs for the period 1950-60 was presented. Only the latest edition of books published in several editions was listed. In a few cases, books published before 1950 were included, chiefly because they still serve as important reference works.

1589. Yamaguchi, E., and Kato, J. STUDIES ON DIKE DESIGN FOR SHORE RECLAMATION. VI. ON THE DISASTER OF DIKES. (Ja) Kyushu Agr. Expt. Sta. B. 5(2): 111-128. Ref. Dec. 1958. 107.6 K996B
English summary.

The causes of the collapse of dikes constructed on polder land in Japan were discussed.

1590. Yamaguchi, E., Kato, J., and Mitsuta, M. DIKE DESIGN FOR SHORE RECLAMATION. V. CONSIDERATIONS FROM THE STANDPOINT OF HYDRAULICS. (Ja) Kyushu Agr. Expt. Sta. B. 5(1): 47-60. May 1958. 107.6 K996B
English summary.

The hydraulics of dike design for shore reclamation in Japan were given. Characteristics of various model waves made by the multiple purpose wave generator were studied as to their effect on the various forms of dike walls.

1591. Yamaguchi, R. EXPERIMENTS WITH HYDRAULIC MODELS. V. DAMS. (Ja) Nogyodoboku-Kenkyu 30(7): 26-33. Ref. Mar. 1963. 290.8 N68

1592. Yamakuchi, E., and Kato, J. STUDIES ON DIKE DESIGN FOR SHORE RECLAMATION. I. SOIL MECHANICAL CONSIDERATIONS. (Ja) Kyushu Agr. Expt. Sta. B. 4(1): 1-13. July 1956. 107.6 K996B
English summary.

A report was given on dike design for land reclamation work in Japan. Plans for embankment works was given along with ways to prevent the sinking of the dikes by shearing when they are constructed on a highly compressible foundation.

1593. Yamakuchi, E., and Kato, J. STUDIES ON DIKE DESIGN FOR SHORE RECLAMATION. II. CONSIDERATIONS FROM THE POINT OF SOIL MECHANICS. (Continued) (Ja) Kyushu Agr. Expt. Sta. B. 5(1): 41-45. May 1958.
English summary.

An additional dike design was given for pile bearing foundations where the load on the piles can be increased gradually with time so that the foundation becomes stronger as the loads are increased.

1594. Yamakuchi, E., Kato, J., and Mitsuta, M. STUDIES ON DIKE DESIGN FOR SHORE RECLAMATION. IV. CONSIDERATIONS FROM THE POINT OF HYDRAULICS. (Ja) Kyushu Agr. Expt. Sta. B. 4(4): 595-609. Ref. Aug. 1957. 107.6 K996B
English summary.

A report on several types of wave generators was given as a preliminary study of the hydraulics for dike designs for Japan as to the effect of the water wave on the design of dikes.

1595. Yamakuchi, E., Kato, J., and Muraoka, S. STUDIES ON DIKE DESIGN FOR SHORE RECLAMATION. III. CONSIDERATIONS FROM THE POINT OF SOIL MECHANICS. (Ja) Kyushu Agr. Expt. Sta. B. 4(4): 581-593. Ref. Aug. 1957. 107.6 K996B
English summary.

The problem of unequal settlement of dikes built on a highly compressible foundation was studied in Japan. It was recommended that a sand-bed or sand-pile works be used to prevent this unequal settlement.

1596. Yamakuchi, E., Kato, J., and Nagaishi, Y. STUDIES ON DIKE DESIGN FOR SHORE RECLAMATION. II. CONSIDERATIONS FROM THE POINT OF SOIL MECHANICS. (Ja) Kyushu Agr. Expt. Sta. B. 4(4): 549-580. Ref. Aug. 1957. 107.6 K996B
English summary.

A report was given on the sliding problems of the structures built on the bearing pile-foundation pierced through the highly compressible stratum.. A new method was given determining the number of piles needed for abutment, sluice-gate, and tidal openings for dikes.

SEE ALSO--370, 509, 519, 610, 701, 708, 934-936, 945, 981, 1017, 1124, 1129, 1162, 1164, 1178, 1253-1255, 1300, 1301, 1327, 1328, 1349, 1353, 1407, 1424, 1445, 1472, 1475, 1597, 1655, 1670, 1723, 1765, 1772, 1775, 1807, 1815, 1834, 1837, 1852, 1864, 1873, 1874, 1876, 1877, 1894, 1910, 1911, 1933, 1939, 1976, 1984, 1999, 2000, 2017, 2018, 2021, 2029, 2051, 2063, 2082, 2105, 2116, 2126, 2131, 2205, 2227, 2230, 2237, 2247, 2248, 2255, 2265, 2283, 2310, 2316, 2335, 2359, 2361, 2383, 2393-2395, 2413, 2484, 2896, 2929, 3520, 3523, 3524, 3551, 3559, 3561, 3577, 3812, 3951, 4041, 4086, 4147, 4231, 4415, 4475, 4477, 4496, 4502, 4509, 4524-4526, 4529, 4539, 4540, 4550, 4557, 4587, 4597, 4598, 4603, 4631-4636, 4639-4641, 4644, 4645, 4651, 4653, 4658, 4677, 4698, 4703, 4725, 4732, 4738, 4772, 4795, 4797, 5118.

RESEARCH IN DRAINAGE REQUIREMENTS AND EFFECTS

Design of Drainage Systems

1597. Abduragimov, T. A., Aver'yanov, S. F., and Rachinskii, V. V. APPLICATION OF A METHOD OF RADIOACTIVE INDICATORS FOR STUDYING THE DYNAMICS OF LEACHING OF SALT SOLUTIONS FROM SOIL ON THE MODEL WITH A DRAIN. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 50: 226-232. Ref. 1963. 106 P44
English summary.
English Trans. 20 pp. Ref. Trans. 13606

A report was given on the use of radioactive indicators to study the leaching of salt solutions from drained soils in the U.S.S.R. A complicated underlating character of leaching was discovered due to the desalinizing effect of drainage.

1598. Abu-Zied, M. A., and Scott, V. H. NONSTEADY FLOW FOR WELLS WITH DECREASING DISCHARGE. Amer. Soc. Civil Engin. Trans. 129: 883. 1964. 290.9 Am3

A digest was given of an article published on the nonsteady flow for wells with decreasing discharge. The original article was published in J. Hydraul. Div., ASCE 89(HY 3): 119-132, May, 1963.

1599. Achtermann, A. SEEPY-PASTURES SPRINGS PAY OFF FOR OHIO FARMERS. Soil Conserv. 29(3): 68-69. 1963. 1.6 So3S

A report was given on the development of pasture springs to provide fresh water for livestock and transform seepy areas to profitable pastures.

1600. Adams, H. W. PUMPING REQUIREMENTS FOR LEVEED AGRICULTURE AREAS. J. Irrig. and Drain., ASCE 83(IR 1, 1236), 23 pp. May 1957. 290.9 Am3Ps

A method of determining the pumping capacity requirements for stations to serve leveed agricultural areas from consideration of basic hydrologic and economic factors was presented. The availability of hydrologic data for general application to drainage problems was discussed and procedures were described to illustrate the method of analysis required for determination of pumping requirements. The economic analysis included an evaluation based on unit costs of pumping to reduce the depth and the extent of flooding as well as the costs to reduce the duration of flooding.

1601. Agnew, L. B. HOW TO INSTALL A PIPE OVERFALL. Soil Conserv. 26(2): 40-41. Sept. 1960. 1.6 So3S

Instructions were given on the installation of pipe overfalls for small drainage ditches.

1602. Agnew, R. RUAWAI FLATS DRAINAGE IMPROVEMENT SCHEME. Soil Water. 1(2): 16-18. map. Dec. 1964. 56.8 So323

A report was given on the development of the Ruawai Flats drainage improvement shceme in New Zealand.

1603. Agreda, T. O. CALCULATION OF THE COEFFICIENTS OF THE FORMULA FOR WATER VELOCITY IN DRAINAGE PIPES. (Sp) Agronomia [Lima] 22(86): 65-67. June/Aug. 1956. 9.8 Ag83

1604. Ahmad, N., and Haq, Z. U. RECLAMATION OF 0.5 MILLION WATERLOGGED ACRES OF RECHNA DOAB. Cong. Irrig. and Drain. Trans. 4(3): 11.471-11.491. maps. 1960. 55.9 C7652

A report was given of the seepage of canal lines of the Rechna Doab area in West Pakistan. This seepage has resulted in a high water table for 0.5 million acres of land. A method was suggested to get quick drainage and remove excess soil moisture accumulation after the monsoon rain.

1605. Akesson, H. A. DRAINAGE OF FOREST ROADS. Pulp and Paper Mag. Canada 64(10): WR382-WR384, WR386-WR387, WR390-WR391. Oct. 1963. 302.8 P96

A report was given on the design of drainage systems needed for forest roads in Canada.

1606. Akyurek, O., and Gizbili, M. THE PROBLEMS RELATED TO THE RECLAMATION OF THE WATERLOGGED AREAS OF THE ADANA COASTAL PLAIN IN TURKEY. Cong. Irrig. and Drain. Trans. 4(2): 11.175-11.192. maps. 1960. 55.9 C7652

Problems related to the reclamation of waterlogged areas in Turkey were discussed. Extensive reclamation investigations being made will form a basis for planning, design, and construction of reclamation and irrigation projects in the plan.

1607. Aleshchenko, V. Y. PLANNING OF LAND LEVELING BY METHOD OF LONGITUDINAL STRIPS (PROFILES). (Rus) Gidrotekh. i Melior. 5: 28-40. May 1963. 290.8 G362

1608. Alfnes, A. ARE SHALLOW DITCHES A MISTAKE? (No) Norsk Landbr. 1958(3): 57. Jan. 1958. 31.11 N8122

1609. Amaya-Brondo, A., and Robles-Espinosa, J. ENGINEERING BUREAUS OF IRRIGATION AND DRAINAGE. (Sp) Ingen. Hidraul. en Mex. 18(1/2): 122-145. map. (Cont.) Jan./June 1964. 290.8 In43

1610. Amer, F., and Elgabaly, M. M. TILE SPACING IN THE NILE DELTA. Alexandria J. Agr. Res. 10(1): 97-109. Jan. 1962. 24 AL2

A report was given on the determination of tile spacing for the Nile Delta in Eqypt.

1611. Amson, F. W. Van. OPTIMAL WIDTH OF BEDS ON HEAVY CLAY SOILS. (Du) Surinaamse Landb. 12(1): 22-29. 1964. 9.6 Su7

1612. Anderson, D. M., and Rees, D. M. A REPORT OF THE FIRST YEAR STUDY ON DEVELOPMENT OF TECHNIQUES FOR MULTIPURPOSE MANAGEMENT OF REUSABLE WATER. Utah Mosquito Abatement Assoc. Proc. 16: 29-30. 1963. 420 Ut1

A progress report was given on water control practices to recommend for mosquito control in marsh areas and farms for multipurpose management of reusable water in Utah.

1613. Anssimov, K. P. SOME CONSIDERATIONS ON TECHNICAL CONDITIONS FOR LEVELLING. (Rus) Gidrotekh. i Melior. 1960(9): 15-18. Sept. 1960. 290.8 G362

1614. Anonymous. FARMING FASTER, EASIER WITH PARALLEL TERRACES. Land Impr. 6(1): 10-11. 1959. 282.8 L224

Farmers in Iowa have found they can save time cultivating fields laid out with parallel terraces which permit use of 4-, 6-, or even 8-row equipment and with less damage to crops; the method also saves wear on machinery by eliminating sharp turns in the field.

The major advantages of parallel terraces are: (1) They speed up planting, cultivating and harvesting; (2) less damage to crops from turning machinery around in the field; and (3) they save wear on equipment by eliminating sharp turns in field work.

1615. Aparicio-Santos, J., Toscano-Romero, E., and Perez-Bryan-Lopez, M. DESIGN OF SOIL CONSERVATION WORKS. (Sp) Internatl. Cong. Agr. Engin. Trans. 5(1): 369-378. 1958, pub. 1960. 290.9 C765C
English summary.

A discussion was given on the design and use of terraces in Spain.

1616. Argyriadis, C. WATER-TABLE VARIATION IN DRAINED STRATIFIED SOILS OVERLYING AN ARTESIAN AQUIFER. J. Agr. Engin. Res. 6(1): 31-36. 1961. 58.8 J82

An electrical resistance analogue was used to determine the effect of soil stratification on the height of the water-table at the midpoint between drains. The analogue represented a soil section overlying an artesian aquifer with four horizontal layers each possessing different permeability. The depth of the drains varied from 4 to 19 feet and the permeability ratios between soil layers from 0.25 to 0.75. The effect of a low-permeability layer overlying the aquifer and underlying more permeable layers was examined for all permeability ratios, drain and aquifer depths, and was expressed in percent change in the height of the water-table above the drain plane.

1617. Argyriadis, C., and Luthin, J. N. CRITERIA FOR TILE DRAIN SPACINGS IN ARTESIAN AREAS. Trans. ASAE 3(1): 87, 89. 1960. 290.9 Am32T

A report was given on the criteria needed for tile drain spacings in artesian areas. The electrical analog method was used to obtain the information because of its simplicity.

1618. Arsov, K. STUDIES ON THE SURFACE WATER RUNOFF IN THE DZHEBEL REGION AND DETERMINING THE SIZE OF TEMPORARY GUTTERS AND FURROWS TO HANDLE IT. (Bu) Plovdiv. Inst. Tyutyuna. Izv. 3: 65-76. 1963. 69.9 P72
English summary.

A report was given on the surface water runoff in the Dzhebel Region of Bulgaria and methods used to control it.

1619. Askochenskii, A. M. ON RESULTS OF THE JOINT SESSION OF THE LENIN ALL-UNION ACADEMY OF AGRICULTURAL SCIENCES AND THE BELORUSSIAN ACADEMY OF AGRICULTURAL SCIENCES. (Rus) Vest. Sel'skokhoz. Nauki 3(10): 104-109. Oct. 1958. 20 V633
English summary.

A report was given from a joint session of the Lenin All-Union Academy of Agricultural Science and the Belorussian Soviet Socialist Republic on problems of reclaiming and cultivating of bogs and water-logged areas. Both achievements and disadvantages of theory and practice of drainage and reclamation were discussed.

1620. Association Francaise Pour L'etude Des Irrigations et Du Drainage. RECLAMATION OF WATERLOGGED SOILS AND SOILS NOT CULTIVATED ON ACCOUNT OF EXCESSIVE MOISTURE. (Fr) Cong. Irrig. and Drain. Trans. 4(3): 11.353-11.370 1960. 55.9 C7652
English summary.

The comprehensive studies that were needed to reclaim waterlogged and wet soils in France were discussed. The need for drainage for irrigated areas was stressed.

1621. Astrakhantsev, V. I. CERTAIN PROBLEMS OF CALCULATING THE WASHOUT OF CANAL BEDS. (Rus) In Akademiia Nauk Sovet po Izucheniiu Proizvoditel'nykh Sil. ISSLEDOVANIIA DEFORMATSII KANALOV I VLIIANIIA OROSHENIIA NA GRUNTOVYE VODY V NIZOV'IAKH AMU-DAR'I. Moskva, Akademiia Nauk SSSR. pp. 70-78. Ref. 1956. 55 Ak131

1622. Augustadt, W. W. DRAINAGE IN THE RED RIVER VALLEY OF THE NORTH. U.S. Dept. Agr., Agr. Ybk. 1955: 569-576. 1955. 1 Ag84Y

A report was given on the drainage requirements of the Red River Valley in North Dakota and Minnesota. Both flood control and drainage problems need to be solved to keep moisture from causing heavy damage to crops in the area. In some respects, the two problems tie in so closely that the author doubts that the problems can be solved separately.

1623. Avall, K. DO AWAY WITH THE OPEN DITCHES. (Sw) Tidskr. f. Landtman och Andelsfolk. 15/16: 386-387. Aug. 1961. 20 T43

1624. Aver'ianov, S. F. COMPUTATION OF DESCENDING AND ASCENDING OF GROUND WATER IN RECLAMATION BY THE SYSTEM OF CANALS (DRAINS). (Rus) Gidrotekh. i Melior. 9(12): 49-61. Ref. Dec. 1957. 290.8 G362

1625. Aver'yanov, S. F., and Abduragimov, T. A. A CONTRIBUTION TO THE THEORY OF LEACHING EFFECT OF THE HORIZONTAL DRAINAGE. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timirvazeva. Dok. 87: 17-28. 1963. 20 M857

1626. Aver'yanov, S. F., and Tsya, D. L. THE THEORY OF LEACHING SALINE SOILS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 56: 15-19. 1960. 20 M857

1627. Baden, W., and Eggelsmann, R. DISCUSSION ON THE POSSIBILITY OF TRANSFERRING HYDROLOGICAL EXPERIMENT RESULTS FROM KONIGSMOOR (HARBURG DISTRICT) TO BODENTEICH (UELZEN DISTRICT). (Ge) Wasser u. Boden. 9(6): 193-194, 196-198. Ref. June 1957. 56.8 W28

1628. Bagirov, S. N. SEASONAL DYNAMICS OF THE MODULE OF DRAINAGE DISCHARGE UNDER CONDITIONS OF THE MUGAN-SALYANY STEPPE. (Rus) Akad. Nauk Azerb. SSR. Dok. 17(12): 1173-1177. 1961. 511 Ak147D

1629. Baissac, A. CALCULATION OF THE CAPACITY AND GRADIENT OF A RUNOFF DITCH. (Fr) Rev. Agr. et Suct. de l'Ile Maurice. 43(4): 382-391. Oct./Dec. 1964. 24 M44

1630. Bakhulin, M. D. ON THE METHOD OF AGRICULTURAL EVALUATION OF THE TERRACE MARSHES. (Rus) Pochvovedenie 1956(12): 66-72. Dec. 1956. 57.8 P34

1631. Balba, A. M. A QUANTITATIVE STUDY OF THE SALINIZATION AND DESALINIZATION PROCESSES OF SOIL COLUMNS. (Hu) Agrokem. es Talajtan. 13(1/2): 25-38. Ref. July 1964. 385 Ag83 English summary.

A report was given on a quantative study in Egypt of the salinization and desalinization process of soil columns. A mathematical relationship was found between the amount of salt leached from or added to the soil and the initial soil content for light textured soils.

1632. Barnes, F. B. A REPORT ON DRAINAGE PROBLEMS IN THE CHISAMBA AREA. Rhodesia Agr. J. 57(2): 152-161. Mar./Apr. 1960. 24 R34

Drainage problems in the Chisamba area of Rhodesia were discussed. The main causes of the waterlogged areas were found to be: (1) Low permeability of the subsoil; (2) hardpan; and (3) high water table. For the hardpan area, it was recommended that the area should be subtilled or deep plowed. Where the water logging is caused by an impermeable subsoil, and/or a high water table, some systems of drainage should be used. The use of tile drains or mole drains was discussed for subsurface drainage but was not considered economical at this time. The Ridge and Furrow method of surface drainage has been successful in the area.

1633. Barnes, O. K., and Bohmont, D. W. EFFECT OF CROPPING PRACTICES ON WATER-INTAKE RATES IN NORTHERN GREAT PLAINS. Wyo. Agr. Expt. Sta. B., 358. 20 pp. 1958. 100 W99

A report was given on the effect of cropping practices on water intake rates in the Northern Great Plains.

1634. Barreto, G. B., Bertoni, J., and Forster, R. SOIL AND WATER LOSSES IN NON-VEGETATED CANALS. (Por) Bragantia. 20(1, nota 6): XXV-XXVIII. 1961. 102.5 B73TB English summary.

Soil and water losses were reported for non-vegetated irrigation canals in Brazil. For slopes of 1 to 10 percent, the amount of water infiltrated was high and soil loss was low. For 20 percent slopes, soil loss was high and water infiltration was low.

1635. Barschdorf, M. CHANNEL IMPROVEMENTS AND MAINTENANCE FOR SURFACE DRAINAGE. (Abs.) Assoc. South. Agr. Workers. Proc. 56: 52-53. 1959. 4 C82

A report was given on channel improvements and maintenance in Mississippi. A modification of Fannings Formula known as the Cyress Creek Runoff Formula was described for the design of major drainage projects in the area. Chemical treatment of Ammate was used to control willows along the channels.

1636. Bartlett, R. J. DRAINAGE OF SLOPING LAND. Vt. Farm and Home Sci. 5(1): 3, 14-15. July 1959. 100 V593

A preliminary report was given on the design and installation of a drainage system installed on hill land in Vermont. The four treatment areas are: (1) Diversion ditches alone; (2) tile systems alone; (3) diversion ditches and tile combined; and (4) a check plot with no drainage.

1637. Bauer, W. J. ECONOMICS OF URBAN DRAINAGE DESIGN. J. Hydraul. Div., ASCE 88(HY 6): 93-114. Nov. 1962. 290.9 Am3Ps

The problem of urban-drainage design was viewed as primarily one of space allocation. In spite of large investments in storm sewers in urban areas, the problems associated with severe rainstorms could not be solved without a system of controlling the location of the volumes of water that occupy space in a watershed during and after periods of excessive rainfall.

Principles underlying the calculation of the volumes of water involved were stated with the aid of the term air-water space, which is the space normally occupied by air but occasionally occupied by water from precipitation. Air-water space was divided into two parts, one above and one below the surface of the earth. The terms flood control and drainage were then seen to be matters of management of air-water space, and of the design, location, or exclusion of objects in air-water space.

1638. Bauer, W. J. ECONOMICS OF URBAN DRAINAGE DESIGN. Amer. Soc. Civil Engin. Trans. 129: 335-336. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a study on the economics of urban drainage design. The original article was published in the J. Hydraul. Div., ASCE 89(HY 3): 21-40., May 1963. References to the discussion and closure were listed.

1639. Bear, J., and Dagan, G. SOME EXACT SOLUTIONS OF INTERFACE PROBLEMS BY MEANS OF THE HODOGRAPH METHOD. J. Geophysical Res. 69(8): 1563-1572. Ref. Apr. 15, 1964. 470 J823

The hodograph method was used to study the shape and position of the interface between two immiscible liquids of different densities when the heavier liquid was at rest. The principles of the method were briefly reviewed. Four cases were presented: (1) An interface in a confined aquifer; (2) upconing toward a sink in an unbounded aquifer; (3) upconing toward a sink in a confined aquifer of infinite thickness; and (4) a drain above the interface in an aquifer of infinite depth. The shape of the interface in each case was presented in the form of an equation and graphs. It was shown that in cases (1) and (3) the approximate solution based on the Dupuit assumption was under certain conditions, sufficiently accurate.

1640. Beasley, R. P. BUILD TERRACES EASIER TO FARM. World Farming. 6(4): 14-16, 18. (Cont.) Apr. 1964. 30.08 W89

A report was given on the design, and use of parallel terraces in Missouri.

1641. Beasley, P. P., and Wooley, J. C. FARM WATER MANAGEMENT FOR EROSION CONTROL. Lucas Bros. Pub., 196 pp. 1957. 56.7 B383

A laboratory manual was given for farm water management for erosion control. The design, installation, and use of terraces, terrace outlets, diversion channels, and waterways were included.

1642. Befani, A. N. BASIC PRINCIPLES OF THE THEORY OF PROCESSES OF SURFACE AND UNDERGROUND RUNOFF. Internatl. Assoc. Sci. Hydrol. B. 6(3): 18-31. Ref. Sept. 1961. 292.9 As7

Basic principles were presented of the theory of processes of surface and underground runoff.

1643. Bekhbudov, A. K. SOME PROBLEMS IN DETERMINING THE MODULE OF DRAINAGE-RUNOFF AND DISTANCES BETWEEN DRAINS IN THE DISTRICTS OF UTILIZATION OF SALINE SOILS. (Rus) Akad. Nauk Azerb. SSR. Izv. Ser. Biol. i Med. Nauk. 1960(4): 105-112. 442.9 Ak132

1644. Benedict, R., Wait, J., Wilkes, W., and Harris, W. LAND GRADING AND LEVELING PROGRAMS FOR DIGITAL COMPUTERS. Ark. Agr. Expt. Sta. B. 691, 35 pp. map. Ref. Aug. 1964. 100 Ar42

A warped surface program for land grading and leveling was written for the IBM 650 digital computer. To facilitate programming, a design method was developed that allows designs to vary within prescribed limits. The warped surface designs result in reduced yardages, length of haul, and associated benefits, as compared with plane surface designs. A plane surface program was also written for this computer.

1645. Berglund, G. AUTOMATIC DATA PROCESSING FOR THE PLANNING OF A DRAINAGE PROJECT. (Sw) Grundforbattring. 16(2): 107-116. 1963. 54.8 G92
English summary.

A report was given on the use of automatic data processing for the planning of a drainage project in Sweden.

1646. Berry, W. L., and Stetson, E. D. DRAINAGE PROBLEMS OF THE SAN JOAQUIN VALLEY. J. Irrig. and Drain., ASCE 85(IR 3, 2160): 97-106. map. Sept. 1959. 290.9 Am3Ps

A report was given on some drainage problems in the San Joaquin Valley in California. The geology and geography of the area was discussed as to its effects on drainage. The objectives and scope of a drainage investigation currently in progress were described.

1647. Berry, W. L., and Stetson, E. D. DRAINAGE PROBLEMS OF THE SAN JOAQUIN VALLEY. Amer. Soc. Civil Engin. Trans. 126(3): 1-9. 1961. 290.9 Am3P

The geography and geology of the San Joaquin Valley of California were outlined, with special emphasis on the factors affecting drainage. The existing drainage problems were unfolded through a description of the cultural changes that have brought them into sharp focus. The objectives

and scope of the drainage investigation in progress were described.
With discussion by Messrs. William W. Donnan; and William L. Berry and Edward D. Stetson. pp. 9-11.

1648. Bertoni, J. TERRACE SPACING FOR ANNUAL CROPS BASED ON SOIL LOSSES AND RUNOFF DATA. (Por) Bragantia. 18(10): 113-140. Ref. 1959. 102.5 B73Tb
English summary.

A terrace spring table was given for annual crops in Brazil that was based on soil loss and runoff data.

1649. Betson, R. P. WHAT IS WATERSHED RUNOFF? J. Geophysical Res. 69(8): 1541-1552. 1964. 470 J823

A nonlinear mathematical model, starting with the integral of an infiltration capacity function, was developed to analytically equate the difference between rainfall and runoff to hydrologic variables. Only the three independent variables—storm rainfall, duration, and soil moisture—was used, and an equation was evolved in which the identity of the coefficients was kept intact and unusually good statistical control was maintained. The coefficients of the equation appear to be stable over a range of watershed sizes and conditions. The equation strongly indicated that runoff usually originates from a small, but relatively consistent, part of the watershed. The function can be manipulated to show a "function of apparent watershed infiltration capacity."

1650. Bianchi, W. C., and Tovey, R. A FARM DRAINAGE INVESTIGATION ON THE ALLUVIAL FAN OF THE TRUCKEE RIVER. Nev. Agr. Expt. Sta. Tech. B. 218, 27 pp. maps. Feb. 1961. 100 N41S

Procedure were developed for characterizing the physical conditions controlling the high water table on an alluvial fan of the Truckee River in Nevada for designing a farm drainage system.

1651. Binsack, R. USE OF NEW DRAINAGE PROCEDURES. (Ge) Mitt. der Deut. Landwirt.-Gesell. 77(38): 1254, 1256-1257. Sept. 20, 1962. 18 N39

1652. Bishop, A. A. RELATION OF INTAKE RATE TO LENGTH OF RUN IN SURFACE IRRIGATION. J. Irrig. and Drain. Div., ASCE 87(IR 1): 23-29. Mar. 1961. 290.9 Am3Ps

The relationship between the intake rate of the soil and the length of run in surface irrigation with regard to the amount of water lost below the root zone through deep percolation was presented. A nomograph was included from which the percentage of loss by deep percolation can be estimated for soils having different intake characteristics.

1653. Blainey, J. M. THE PROBLEM OF EXCESSIVE IRRIGATION AND DRAINAGE. Austral. Dried Fruit News. 35(1): 38-43, 45, 47-49. Jan./Mar. 1960. 286.83 Au72

A report was given on the problem of excessive irrigation and drainage for horticultural crops in Australia.

1654. Blaisdell, F. W. FLOW THROUGH DRAIN TILE JUNCTIONS. The Brick and Tile Lines. 11(3): 4. 1963.

Research was reported on the flow of water through tile drain junctions.

1655. Blaisdell, F. W., and Manson, P. W. HYDRAULIC CHARACTERISTICS OF THE JUNCTIONS OF EQUAL-SIZED DRAINAGE TILE. Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comn. VI): 561-568. 1956. 56.09 In8452

The junction energy loss for agricultural drainage tile systems were determined by laboratory tests. In an agricultural drainage system designed in accordance with good drainage practices in the United States, the 90-degree junction was as good as the 45-degree junction from a practical standpoint.

1656. Blaisdell, F. W., and Manson, P. W. LOSS OF ENERGY AT SHARP-EDGED PIPE JUNCTIONS IN WATERS CONVEYANCE SYSTEMS. U.S. Dept. Agr. Tech. B. 1283, 163 pp. Ref. Aug. 1963. 1 Ag84Te

A report was given of a 5-year test program to determine energy losses at sharp-edged pipe junctions in Minnesota. Previous work on determining energy losses at pipe junctions were described. The theory of converging pipe junctions was presented along with a description of the apparatus and procedures. The test data was explained and analyzed. The results were summarized and compared with those of other investigations.

1657. Blake, G. R., Allred, E. R., Van Bavel, C. H. M., and Whisler, F. D. AGRICULTURAL DROUGHT AND MOISTURE EXCESSES IN MINNESOTA. Minn. Agr. Expt. Sta. Tech. B. 235, 36 pp. 1960. 100 M66

This study predicts drought probability, i.e., the number of days per month or season that rainfall is insufficient to supply the needs of growing plants after available soil moisture is depleted for Minnesota. The data were based on a statistical study of past amount and distribution of rainfall at 22 stations. Fundamental information was given on average monthly evapotranspiration at some stations. There was also a summary of the amount of precipitation in excess of plant needs and of the ability of soils to store it.

Information of this nature is basic to water planning for both agricultural and urban uses. In agriculture, it can serve as a guide in problems of irrigation need and in the disposal of excess water.

1658. Blazhis, B. I. A NEW FORMULA FOR HYDRAULIC COMPUTATIONS ON TILE-DRAINAGE PIPES. (Rus) Gidrotekh. i Melior. 1962(3): 29-32. Mar. 1962. 290.8 G362

1659. Blewitt, R. DIVERSION DITCHES ON SUGAR CANE LANDS IN HAWAII. Il. World Farming. 4(9): 34, 36, 38-40. Sept. 1962. 30.08 W89

A report was given on the design and layout of diversion ditches for sugarcane land in Hawaii.

1660. Boddy, H. LAND LEVELING: THE SECRET IS IN PLANNING. Farm Mangt. 7(12): 26-27. 1958. 281.8 F2225

A "popular type" article was given on the use of planning for land leveling of irrigated lands.

1661. Boelter, D. H., and Blake, G. R. IMPORTANCE OF VOLUMETRIC EXPRESSION OF WATER CONTENTS OF ORGANIC SOILS. Soil Sci. Soc. Amer. Proc. 28(2): 176-178. 1964. 56.9 So3

Methods for evaluating water contents and bulk densities of several different peats were compared. Because bulk densities (saturated volume basis) of moss, herbaceous, and aggregated peats varied from 0.028 to 0.249 g. per cc., a highly distorted impression of the amount of water actually held under field conditions was given if water values were expressed on an oven-dry weight basis.

1662. Bornstein, J. HELP FOR WET CROPLAND. Vt. Farm and Home Sci. 6(1): 10-11. Summer 1963. 100 V593

A report was given on drainage research being conducted in Vermont on interception ditches, diversion ditches, tile drainage, and subdrains.

1663. Bornstein, J. GROUND WATER MOVEMENT IN POORLY DRAINED GLACIAL TILL SOIL. Trans. ASAE 7(1): 38-41, 45. 1964. 290.9 Am32T

A report was given on the use of piezometer stations to study ground water movement in Cabot loam in Vermont. The data indicated the need of both diversion ditches and tile drainage.

1664. Boumans, J. H., and Someren, C. L. Van. PRESENT PROBLEMS IN DRAINAGE TECHNIQUE. (Du) Netherlands. Rlandbvoorlichtingdienst. Landbvoorlichting. 20(8/9): 531-536. Aug./Sept. 1963. 12 N383M

1665. Bouwer, H. THEORETICAL ASPECTS OF UNSATURATED FLOW IN DRAINAGE AND SUBIRRIGATION. Agr. Engin. 40(7): 395-400. Ref. July 1959. 58.8 Ag83

Numerical procedures were proposed for obtaining solutions of unsaturated flow in drainage and subirrigation under realistic conditions of flow.

1666. Bouwer, H. THEORETICAL ASPECTS OF FLOW ABOVE THE WATER TABLE IN TILE DRAINAGE OF SHALLOW HOMOGENEOUS SOILS. Soil Sci. Soc. Amer. Proc. 23(4): 260-263. July/Aug. 1959. 56.9 So3

Hypothetical conductivity-tension relationships were employed in a study to determine the effect of the thickness of the capillary fringe and the relative conductivity above the capillary fringe on tile drainage flow. Solutions were obtained with an electrical resistance network using equivalent conductivities.

1667. Bouwer, H. ANALYZING GROUND-WATER MOUNDS BY RESISTANCE NETWORK. J. Irrig. and Drain. Div., ASCE 88(IR 3): 15-36. Sept. 1962. 290.9 Am3Ps

A technique for predicting quantitative behavior of ground-water mounds below recharge areas was presented. The technique was applicable to stable or moving mounds, two-dimensional or radial flow systems, and uniform or non-uniform soils.

1668. Bouwer, H. THE FLOW SYSTEM BELOW A WATER SPREADING BASIN. Internatl. Comm. Irrig. Drain. Proc. Cong. 5: 18.89-18.106. 1963. 55.9 In8A

The flow system between a recharge basin and the lower mound may consist of a number of perched mounds and percolation zones. The flow conditions governing formation and recession of individual mounds can be of considerable complexity. With a resistance network analog, non-uniformities and complexities in soil and boundary conditions can be taken into account. Solutions may be obtained regarding rise, fall, or equilibrium state of mounds above original water tables and perching layers for two-dimensional or axially symmetrical flow systems.

1669. Bouwer, H., and Little, W. C. A UNIFYING NUMERICAL SOLUTION FOR TWO-DIMENSIONAL STEADY FLOW PROBLEMS IN POROUS MEDIA WITH AN ELECTRICAL RESISTANCE NETWORK. Soil Sci. Soc. Amer. Proc. 23(2): 91-96. 1959. 56.9 So3

A method using an electrical resistance network for solution of two-dimensional steady flow problems was described and illustrated.

Examples of completed analyses included a solution of flow in tile-drained soil with the saturated and unsaturated zone united into one system and a solution of unsaturated subirrigation flow from perforated underground tubing in the presence of a deep water table.

1670. Bouwer, H., Myers, L. E., and Rice, R. C. EFFECT OF VELOCITY ON SEEPAGE AND ITS MEASUREMENT. Amer. Soc. Civil Engin. Trans. 128(3): 279-292. 1963. 290.9 Am3

The direct effect of velocity in a canal on seepage rates and the effect of the velocity pattern distortion around a seepage-meter bell on the local head environment of the bell were studied in a laboratory flume. Velocity did not directly affect seepage rates, but the velocity distortion around the bell caused the average head around the seepage meter to be less than that caused by the free water surface in the canal. Correction factors to convert the free water surface to the proper reference level for seepage measurement with bell-type devices were evaluated. It was shown that correcting the free water surface for velocity-induced pressure differences was only necessary in case of low seepage gradients. The absence of a direct effect of velocity on seepage indicated that measuring seepage from flowing canals by means of still water bodies (in ponded sections or inside seepage bells) was correct in principle.

1671. Bouwer, H., and van Schilfgaarde, J. SIMPLIFIED METHOD OF PREDICTING FALL OF WATER TABLE IN DRAINED LAND. Trans. ASAE 6(4): 288-291, 296. Ref. 1963. 290.9 Am32T

A simplified procedure was presented for predicting fall of water table in tile or ditch drained lands. The procedure was discussed and compared with other solutions. The procedure was amenable to steady-state formulas or to graphic or tabular solutions obtained by analogs, models, numerical procedures, filed experiments, or others.

1672. Bouwman, L. H. DETAIL DRAINAGE. I. (Du) Inzicht. 15(10): 116-119. Oct. 1961. 44.8 In9

1673. Bouwman, L. H. DETAIL DRAINAGE. II. (Du) Inzicht. 15(11): 139-142. Nov. 1961. 44.8 In9

1674. Bouwman, L. H. DETAIL DRAINAGE. III. (Du) Inzicht. 16(1): 10-12. Jan. 1962. 44.8 In9

1675. Bouwman, L. H. DETAIL DRAINAGE. IV. (Du) Inzicht. 16(2): 24-26. Feb. 1962. 44.8 In9

1676. Bouwman, L. H. DETAIL DRAINAGE. V. (Du) Inzicht. 16(3): 42-45. Mar. 1962. 44.8 In9

1677. Bower, C. A., and Lunin, J. PROBLEMS OF SOIL AND WATER. U.S. Dept. Agr., Agr. Ybk. 1964: 535-542. 1964. 1 Ag84Y

A discussion was given on research on problems of soil and water-including drainage, drainage of irrigated lands, drainage for salinity control, and effect of saline irrigation water on crops and soils.

1678. Bowler, D. G. PLANNED FARM DRAINAGE. Ruakura Farmers' Conf. Week Proc. 1955: 152-158. 1955. 49.9 R82

A lecture and discussion were given on planned farm drainage for New Zealand. The planning and installation of tile and mole drainage was stressed. The cost of installation of both systems were discussed.

1679. Bowler, D. G. WHAT FARMERS SHOULD KNOW ABOUT DRAINAGE. New Zeal. Meat Prod. 3(11): 23-24. Aug. 1959. 50.8 N48

A "popular" discussion was given on the need and use of drainage in New Zealand.

1680. Bowler, D. G. THE USES OF AERIAL PHOTOGRAPHY IN FARM DRAINAGE. Massey Agr. Col. Sheepfarming Annu. 1959: 89-92. Sept. 1959. 45.9 M38S

A report was given on the use of aerial photographs for farm drainage in Australia.

1681. Bowler, D. G. GUIDE FOR DEVELOPMENT OF WET HILL COUNTRY FLATS. New Zeal. Meat Prod. 4(8): 18-19. May 1960. 50.8 N48

A report was given on the surface and subsurface drainage needs for wet hill country flats in New Zealand.

1682. Bowler, D. G. METHODS OF DRAINAGE AND A GUIDE TO THEIR SELECTION. Massey Univ. Manawatu Sheepfarming Annu. 1964: 10-17. 45.9 M38S

A discussion was given on the various types of surface and subsurface drainage as a guide for their selection and use in New Zealand.

1683. Boyer, M. C. IRRIGATION AND DRAINAGE POTENTIALS IN HUMID AREAS. J. Irrig. and Drain., ASCE 86(IR 3, 2593): 51-61. map. Sept. 1960. 290.9 Am3Ps

A report was given on the role of civil engineer in the development of irrigation and drainage potentials in humid areas.

1684. Braams, B. W., and Butijn, J. DRAINAGE IN FRUIT-GROWING. (Du) Netherlands. Dir. van de Tuin-bouw. Meded. 21(11): 763-770. Nov. 1958. 86 N384
English summary.

Criteria for tile drainage for fruit land were given for the Netherlands based on experiences and observations.

1685. Braine, S. T. SOIL AND WATER CONSERVATION; TRACER FOR MARKING CONTOUR DRAINS. Ceylon Coconut Planters' Rev. 3(1): 20-21. July/Sept. 1962. 77.8 C333

An illustrated report was given on a simple tracer used in India for marking out contour drains.

1686. Brauer, B. PASTURE AND BUILDINGS NOT TO BE NEGLECTED. (Ge) Mitt. der Deut. Landwirt.-Gesell. 74(21): 650-652. May 21, 1959. 18 N39

1687. Breitenoder, M., and Zanker, K. THE WITHDRAWAL OF PRECIPATATION WATERS PENETRATED IN MINERAL SOILS BY DRAINAGE. (Ge) Schrreihe. des Kuratoriums f. Kultbauw. 8, 123 pp. 1960. 18 Sch73

1688. Brink, N. ARABLE LAND VALUE AS A FUNCTION OF SOIL DEPTH OVER UNDERGROUND WATER. (Sw) Grundforbattring. 16(2): 117-119. 1963. 54.8 G92
English summary.

An algebaric equation was given for an arable land value as a function of soil depth over underground water. The relation was discussed between drainage depth and crop yields in Sweden.

1689. Bronitskii, N. I. INITIAL RESULTS OF THE USE OF VERTICAL DRAINAGE ON THE GOLODNAYA STEP. (Rus) Gidrotekhi. i Melior. 1961(9): 24-32. Sept. 1961. 290.8 G362

1690. Bronitskii, N. I. HORIZONTAL AND VERTICAL DRAINAGE IN THE OLD ZONE OF THE GOLODNAYA STEP. (Rus) Gidrotekh. i Melior. 9: 12-20. Sept. 1962. 290.8 G362

1691. Brooks, R. H. UNSTEADY FLOW OF GROUND WATER INTO DRAIN TILE. J. Irrig. and Drain. Div., ASCE 87(IR 2): 27-37. June 1961. 290.9 Am3Ps

A solution was given to a nonlinear differential equation describing unsteady flow toward equally spaced drains above a horizontal impermeable boundry. When compared with field data and a published numerical solution, the solution was found to agree when the drain spacing was large relative to the depth of drain.

1692. Brooks, R. H. UNSTEADY FLOW OF GROUND WATER INTO DRAIN TILE. Amer. Soc. Civil Engin. Trans. 128(3): 117-127. 1963. 290.9 Am3

A solution to the nonlinear differential equation describing unsteady flow toward equally spaced drains above a horizontal impermeable boundary was presented.

The solution was compared with field data and a published numerical solution. The solution was found to agree with the field data and the numerical solution when the drain spacing was large relative to the depth of drains.

With discussion by Suresh P. Brahma; and R. H. Brooks. pp. 127-129.

1693. Brooks, R. H. EVALUATING FLOW MEASURING DEVICES FOR DRAINAGE SYSTEMS. Agr. Engin. 44: 557, 560. 1963. 58.8 Ag83

Three instruments (a pitot-static tube, a midget current meter, and a collapsible 90-degree V-notch weir) were evaluated in a laboratory for accuracy and ease of operation in measuring flow within a drainage tile system. The V-notch weir appeared to be the best suited for field use.

1694. Brudastova, R. A. ON THE KINETICS OF THE WATER FLOWING DOWN FROM THE DRAINED SOILS. (Rus) Gidrotekh. i Melior. 10(10): 31-35. Ref. Oct. 1958. 290.8 G362

1695. Brutsaert, W., Taylor, G. S., and Luthin, J. N. PREDICTED AND EXPERIMENTAL WATER TABLE DRAWDOWN DURING TILE DRAINAGE. Hilgardia. 31(11): 389-418. Ref. Nov. 1961. 100 C12H

Comparisons were made between predicted and experimental water table drawdown during tile drainage by an electrical resistance network system.

1696. Budyka, S. K. CHIEF METHODS AND PRINCIPLES OF HYDROTECHNICAL AMELIORATION OF POLESYE FORESTS. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 142-153. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the chief methods and principles for the design and use of forest drainage in Polesye swamped forests.

1697. Buie, T. S. FLAT FIELDS MUST BE DRAINED. Better Crops Plant Food. 44(2): 12-15. Mar./Apr. 1960. 6 B46

A report was given on the need and use of drainage for flat fields.

1698. Buniatian, L. B. CALCULATING THE VOLUMES OF PUMPABLE WATER IN VERTICAL DRAINAGE. (Rus) Gidrotekh. i Melior. 8(12): 14-21. Dec. 1956. 290.8 G382

1699. Buras, N., and Pillsbury, A. F. LATERAL MOVEMENT OF WATER ALONG A GLASS FIBER SHEET USED AS A DRAINTILE FILTER. Trans. ASAE 6(2): 173, 176. 1963. 290.9 Am32T

Hydraulic conductivity along a glass fiber sheet for a tile filter was tested in California. When the flow of water along the glass fiber was assumed to have reached steady state, the hydraulic conductivity was very close to that of coarse sand.

1700. Burke, W. DRAINAGE INVESTIGATION ON BOGLAND: THE EFFECT OF DRAIN SPACING ON GROUND WATER LEVELS. Irish J. Agr. Res. 1(1): 31-34. Ref. Oct. 1961. 10.5 Ir45

A report was given on the effect of drain spacings on ground water levels in blanket peat in boglands in Ireland. A lowered ground water was found only to a distance of 5 or 6 feet from the edge of the drain.

1701. Burnett, G. I. S. WATER AND FARMING. III. TILE AND MOLE DRAINS NEED EXPERT PLANNING. New Zeal. Meat Prod. 8(1): 33. Oct. 1, 1963. 50.8 N48

A report was given on the drainage design needs for tile and mole drainage in New Zealand.

1702. Busch, K. F. A CONTRIBUTION TO PROBLEMS OF DRAIN DISTANCE AND DEPTH IN MINERAL SOILS. (Ge) Z. f. Landeskult. 4(2): 107-149. map. Ref. 1963. 282.9 Z3
English summary.

A report was given on methodology of calculation to determine drain spacings and drainage depths in Germany and how research on drainage is being used to correct the system now used.

1703. Buss, K. THE OPTIMAL DEGREE OF FOREST DRAINAGE INTENSITY IN LATVIA. (La) Jaunakais Mezsaimnieciba. 3: 23-29. Ref. 1962. 99.8 J32

1704. Butler, E. D. LAND LEVELING IN THE ARKANSAS DELTA: ENGINEERING PRACTICES RECOMMENDED FOR SERVICING LANDOWNERS. Agr. Engin. 42: 128-131. 1961. 58.8 Ag83

Approximately 10 million acres of nearly level, deep, fertile bottomland soils underlain with abundant water-bearing sand are in the Delta area of eastern Arkansas.

Land-leveling design criteria was balanced between the conflicting needs for drainage and irrigation. Grades between 0.1 and 0.3 feet per 100 feet were recommended.

Drainage systems must always be planned in conjunction with irrigation systems. Field dimensions are usually determined by required location of drainage ditches rather than from irrigation requirements. Because of the depth of the soil and the relatively flat topography, the depth of cut is seldom a problem.

1705. Caldart, F. THE PRACTICE OF DRAINAGE IN CONTROL OF LANDSLIDES. (It) Monti e Boschi. 9(4): 168-180. Apr. 1958. 16 M76
English summary.

A method was given of drainage of clay-marl soils to prevent landslides in Italy. The method eliminates water infiltration and helps remove water that has already penetrated.

1706. California Legislature Joint Committee on Water Problems. DRAINAGE PROBLEMS OF THE SAN JOAQUIN VALLEY OF CALIFORNIA. San Francisco, 1957. 78 pp. 1957. 292 C122Re

The evidence presented to the joint committee on water problems showed conclusively that the drainage and degradation in water quality conditions in the San Joaquin Valley in California are now seriously impairing agricultural production, forcing changes in crop patterns, and generally affecting the economy of the valley. The situation is steadily growing worse and is rapidly approaching a crisis. The engineers of both State and Federal agencies studying the problem has recommended construction of a main stem, master drain as the proper solution.

1707. Calzecchi-Onesti, A. HILL DRAINAGE AND THE ROOF TECHNIQUE. (It) Gior. di Agr. 65: 85-86. Mar. 13, 1955. 16 It1G

1708. Calzecchi-Onesti, A. ASPECTS OF FIELD DRAINAGE. (It) Gior. di Agr. 66: 117-118. Mar. 25, 1956. 16 It1G

1709. Calzecchi-Onesti, A. DRAINAGE AND WATER USEFUL TO THE FIELDS. (It) Gior. di Agr. 66: 227-228. June 17, 1956. 16 It1G

1710. Camp, T. R. WATER AND ITS IMPURITIES. Reinhold Pub. Corp. 355 pp. 1963. 292 C15

A report was given on water and its pollution control.

1711. Cano-Vicario, A. SANITARY ASPECTS OF THE PLAN TO UTILIZE THE HYDRAULIC RESOURCES OF THE VALLEY OF MEXICO. (Sp) Ingen. Hidraul. en Mex. 16(1): 77-91. maps. Jan./Mar. 1962. 290.8 In43
English summary.

The drainage requirements and protection of storages of drinking water behind dams in Mexico were discussed. The discharges of sewage water and industrial waste represents the main problem of drainage for the area.

1712. Cavelaars, J. C. FLOW OF WATER TO DRAINS. (Du) Nederland. Heidemaatsch. Tijdschr. 73(12): 391-398. Dec. 1962. 12 N282

1713. Chang, C. P. THE STUDY OF LAND GRADING PLAN ON THE DRY FIELD. (Ch) Taiwan Water Conserv. (ser. 11)4(44): 60-66. Dec. 1963. 292.8 T13
English summary.

A land grading plan designed for surface drainage for surface irrigation in Taiwan was described.

1714. Cherkasov, A. A. METHODS OF DRAINING EXCESSIVELY MOIST AND FLOOD LANDS. (Rus) Timiriazevskaia Sel'skokhoz. Akad. Izv. 2: 211-224. 1955. 106 P44

1715. Childs, E. C. THE SCIENTIFIC ASPECTS OF FIELD DRAINAGE. Sci. Prog. (London) 44: 208-233. Ref. Apr. 1956. 472 Sci22

A discussion was given on the scientific aspects of field drainage for the design of drainage systems in England.

1716. Childs, E. C. A TREATMENT OF THE CAPILLARY FRINGE IN THE THEORY OF DRAINAGE. J. Soil Sci. 10: 83-100. 1959. 56.8 J822

The hodograph treatment of the problem of drain design, as developed by van Deemter, was suitably modified to take into account the presence of a capillary fringe above the water table. Examples were presented to show that the presence of the fringe requires an increase of optimum drain size, and that thick fringes are accommodated mostly above a water table which is not proportionately much depressed below that which is appropriate to an absence of fringe, while thin fringes are accommodated in approximately equal proportions above and below the level of the fringeless water table.

1717. Childs, E. C. THE NONSTEADY STATE OF THE WATER TABLE IN DRAINED LAND. J. Geophysical Res. 65(2): 780-782. Feb. 1960. 470 J823

A discussion was given on the nonsteady state of the water table in drained land in England.

1718. Childs, E. C. A TREATMENT OF THE CAPILLARY FRINGE IN THE THEORY OF DRAINAGE. II. J. Soil Sci. 11(2): 293-304. Sept. 1960. 56.8 J823

A report was given on a study in England of the capillary fringe in the theory of drainage by finding the modifications due to an impermeable substratum.

1719. Childs, E. C., and Youngs, E. G. THE NATURE OF THE DRAIN CHANNEL AS A FACTOR IN THE DESIGN OF A LAND-DRAINAGE SYSTEM. J. Soil Sci. 9(2): 316-331. Ref. Sept. 1958. 56.8 J823

A study was made of the design of a land-drainage system where the drainage channel consists of a number of short lengths of relatively impermeable pipe separated by gaps of casual width. The material may be of baked clay, concrete, bitumenized fiber, carboard, polyethene sheet, or polyethene tubing.

1720. Childs, E. C., and Youngs, E. G. A STUDY OF SOME THREE-DIMENSIONAL FIELD-DRAINAGE PROBLEMS. Soil Sci. 92(1): 15-24. Ref. July 1961. 56.8 So3

The Dupuit-Forchheimer approximation was adopted to deduce relationships between rate of rainfall, soil hydraulic conductivity, and the geometry of the drainage system for three-dimensional systems comprising arrays of pumped wells and rectangular meshes of major and minor drains. The theoretically deduced relationships compared favorably with experiments with drainage systems and with numerical solutions for particular cases obtained by the relaxation method.

1721. Chirikin, N. I. THE CONDITION OF RECLAMATION OF LANDS WITH A DRAINAGE NETWORK IN KIROV REGION. (Rus) Moscow Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy. 37: 134-146. 1962. 292.9 M85

1722. Chirikin, N. I. ON THE DEPTH OF DRAINAGE OF MARSHES FOR PERENNIAL CULTIVATED PASTURES. (Rus) Gidrotekh. i Melior. 10: 36-44. Oct. 1964. 290.8 G362

1723. Chow, V. T. OPEN-CHANNEL HYDRAULICS. McGraw-Hill Book Co. 680 pp. 1959. 290.9 C45

A textbook was given on the hydraulics of open channel flow.

1724. Chow, V. T. HYDROLOGIC DESIGN OF CULVERTS. J. Hydraul. Div., ASCE 88(HY 2) :39-55. Mar. 1962. 290.9 Am3Ps

The development of a practical procedure for the determination of peak discharges for the design of culverts or other drainage structures on small rural watersheds was presented. Although the procedure illustrated was prepared for design conditions in Illinois, the concept involved is universally applicable to other areas, provided that adequate data are available for similar analysis and development.

1725. Chow, V. T. HYDROLOGIC SETERMINATION OF WATERWAY AREAS FOR THE DESIGN OF DRAINAGE STRUCTURES IN SMALL DRAINAGE BASINS. U. Ill. Engin. Expt. Sta. B. 462, 104 pp. Ref. 1962. 290.9 IL62B

A scientific, simple, and practical method was given to determine the peak discharge of flow from small rural drainage basins for the design of waterway openings of major drainage structures. A design chart was given for climatic and physiographic conditions in Illinois.

1726. Chu, Y. RECLAMATION OF TIDAL LAND IN YUNLIN. Taiwan Sugar. 8(11): 17-20. Nov. 1961. 65.8 T133

A description was given of the reclamation of tidal land in Yunlin in Taiwan. The success of reclamation of tidal lands depends, besides a comprehensive engineering design, upon effective windbreak and good drainage.

1727. Chuang, H. C. THE STABILITY ANALYSIS OF LONG SLOPE EARTHWORKS IN IRRIGATION CANALS. (Ch) Taiwan Water Conserv. 12(4): 52-58. Dec. 1964. 292.8 T13

1728. Clarke, K. A. THE USE OF AERIAL PHOTOGRAPHS IN THE PREPARATION OF FARM DRAINAGE PLANS IN THE PROVINCE OF ONTARIO, CANADA. FATIS Rev. 7(2): 43-44. 1960. 275.249 F26

A report was given on the use of aerial photographs to prepare farm drainage plans in Canada.

1729. Collett, G. C. SOURCE REDUCTION IN UTAH. Utah Mosquito Abatement Assoc. Proc. 16: 3-5. 1963. 420 Ut1

A report was given on the elimination of breeding places of mosquito in Utah by proper drainage and seepage control.

1730. Collis-George, N., and Youngs, E. G. SOME FACTORS DETERMINING WATER-TABLE HEIGHTS IN DRAINED HOMOGENEOUS SOILS. J. Soil Sci. 9(2): 332-338. Ref. Sept. 1958. 56.8 J823

The effects of the depth of an impermeable floor below the drain level on water table heights in homogeneous soils, drained by a uniform system of ideal drains, for steady state conditions with various rainfall intensities, were investigated. Hydraulic models and electric analogue experiments were used in the study.

1731. Commonwealth Bureau of Soils. SELECTED BIBLIOGRAPHY ON CLAY AND SILT SPREADING. (1964-1941). Commonwealth Bur. Soils [Annot. Bibliog.] 769, 9 pp. 1964. 241 C743A

An annotated bibliography was given on the use of clay or silt spread over soil for the period 1941-1964.

1732. Copeland, J. T. 4-H DRAINAGE EXERCISES. Miss. State Col. Ext. P. 327, 16 pp. May 1956. 275.29 M68Ext

A 4-H Club guide was given for drainage practices in Mississippi.

1733. Coradini, M. THE "SCOLINA" IN LAND DRAINAGE. (It) Agr. Sarda. 33(11): 323-324. Nov. 1956. 16 Ag825

1734. Culp, M. M. SOME NOTES ON DRAINAGE STRUCTURES. Trans. ASAE 3(1): 90-91, 96. 1960. 290.9 Am32T

The objectives or purposes of a sound drainage plan are: (1) To remove excess water; (2) to protect the area being drained from external water; (3) to adapt the work under (1) and (2) to the existing works of man and his other needs; and (4) to sustain the principle drainage works. Some notes were given on structures needed for each of the above purposes.

1735. Dagan, G. LINEARIZED SOLUTION OF UNSTEADY DEEP FLOW TOWARD AN ARRAY OF HORIZONTAL DRAINS. J. Geophysical Res. 69(16): 3361-3369. 1964. 470 J823

An approximate method for predicting water table fluctuations caused by a variable recharge was presented. It was assumed that the drains are at the water table and that the drained permeable stratum is deep, homogeneous, and isotropic. The main approximation of the flow system is the linerarization of the boundary condition on the free surface. In this way the problem was reduced to the solution of a Volterra integra equation of the first kind, which was solved by a numerical technique. The results were presented in a dimensionless form in tables and graphs.

1736. Dagan, G. SPACING OF DRAINS BY AN APPROXIMATE METHOD. J. Irrig. and Drain., ASCE 90(IR, proc. paper 3824): 41-66. Mar. 1964. 290.9 Am3Ps

The steady saturated seepage of rainfall toward an array of tile drains or drainage ditches in a layer of finite thickness was investigated by an approximate analytic method. Formulas and tables were presented for the calculation of the maximum drawdown caused by drains located at and below water table and ditches for both isotropic and nonisotropic soils.

1737. Datta, R. R. DESIGN OF STABLE CHANNEL IN COHERENT SOIL. Irrig. and Power. 14(1): 96-104. Jan. 1957. 55.9 In222C

A method for the design of stable irrigation canals with steep slopes on coherent soils was given for India mainly by using Lacey's formulas. The non-silting velocity of the channel and the non-scouring velocity were determined and considered.
The author concluded that the introduction of a "working silt factor" into the design of ridge canals will greatly cut down the cost of river valley irrigation projects.

1738. Davis, J. R. DESIGN OF IRRIGATION TAILWATER SYSTEMS. Trans. ASAE 7(3): 336-338. Ref. 1964. 290.9 Am32T

A report was given on the design of irrigation tailwater systems to prevent ponding of the excess water to prevent crop loss and aid in mosquito control. Ponding may be prevented by the following: (1) Surface or subsurface gravity drains; (2) collecting and pumping water into an outlet; and (3) collecting and pumping water for beneficial irrigation purposes.

1739. Day, P. R., and Luthin, J. N. A NUMERICAL SOLUTION OF THE DIFFERENTIAL EQUATION OF FLOW FOR A VERTICAL DRAINAGE PROBLEM. Soil Sci. Amer. Proc. 20: 443-447. Oct. 1956. 56.9 So3

The drainage rate of a uniform soil overlying a continuous gravel substratum is difficult to predict because the soil moisture tension and the capillary conductivity of the soil vary with the water content. An illustration and experimental test of Richards differential equation of flow were given for the drainage of a column of fine sand.

1740. Debler, W. R. STRATIFIED FLOW INTO A LINE SINK. Amer. Soc. Civil Engin. Trans. 126(1): 491-504. 1961. 290.9 Am3

The discharge of a stratified fluid (with a stable linear density variation at infinity) through a horizontal slot at the end of a channel was experimentally investigated. The experiments showed that when the densimetric Froude number was less than 0.28, the flow pattern was divided into two horizontal regions; an upper, essentially a stagnant region, and a lower region in which the entire discharee was concentrated. The specific results obtained were useful for the solution of engineering problems involving stratified flows.

1741. Degtyarev, B. M. EXPERIMENTAL STUDY OF A VACUUM DRAINAGE SYSTEM. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 87: 143-149. 1963. 20 M857

1742. Dejou, J. A STUDY OF THE HYDROMORPHIC SOILS AND PEATS OF THE ARANC MARSH (AIN). (Fr) Ann. Agron. 15(1): 23-58. 1964. 14 F8499
English summary.

A report was given on the recommendation for drainage and reclamation of the waterlogged soils and peats of the Aranc Marsh in France.

1743. Dellenbach, P., Chabert, F. De., and Audibert, M. CONTRIBUTION TO THE STUDY OF THE FLOW OF WATER IN TILE DRAINS. (Fr) Agr. Engin. Trans. 5(1): 83-100. 1958, pub. 1960. 290.9 C765C
English summary.

A laboratory investigation was reported on the flow of water through tile drains. The Chezy and the Manning-Strickler formula appeared to be comparable in the case of flow in tile drains. The formula gave a good agreement for computing the velocities; the discharges, however, have to be reduced by 50 percent because the tile drain is never running full.

1744. Dellenbach, P., Chabert, F. De., and Audibert, M. CONTRIBUTION TO THE STUDY OF WATER FLOW IN DRAINAGE CANALS. (Fr) Ecole Natl. d'Agr. Ann. (n.s.)30(4): 3-21. Nov. 1962. 105.3 M76

1745. Denmark Statens Forsogsvirksomhed I Plantekultur. EXPERIMENTS WITH DIFFERENT DRAINAGE DEPTH AND DRAINAGE DISTANCE ON MARSHLAND. (Da) Tidsskr. f. Planteavl. 68(1): 177-180. 1964. 11 T439

1746. DeWiest, R. J. M. ON THE THEORY OF LEAKY AQUIFERS. J. Geophysical Res. 66(12): 4257-4262. Dec. 1961. 470 J823

Potential distribution was found for two cases of unsteady flow in a finite leaky aquifer, where the boundary condition at the contour of influence is time dependent and where the initial condition is one of different head in the main aquifer and in the semiconfining and quasi-impervious layer overlying it. The cases considered were a well pumped at a constant discharge and a flowing well at constant drawdown.

1747. De Zeeuw, J. W., and Hellinga, F. PRECIPITATION AND RUNOFF. (Du) Landbouwkundig Tijdschrift. 70: 405-422. 1958.

1748. Diaz-Ambrona, D. RECLAMATION OF WATERLOGGED AND MARSHY LANDS. Cong. Irrig. and Drain. Trans. 4(2): G11.1-G11.52. 1960. 55.9 C7652

A general review was given of the 39 papers presented on the reclamation of waterlogged and marshy lands.

1749. Dill, H. W. LAND CLEARING AND DRAINAGE DATA FROM AIRPHOTO INTERPRETATION. Agr. Econ. Res. 9(3): 96-100. July 1957. 1 Ec7Agr

An airphoto interpretation method was described that supplies suitable land clearing and drainage data for economic studies with considerable savings in personnel time and overall costs over the original method (detailed field studies by direct mapping plus farmer interviews.)

1750. Dluzewski, J. ANALYSIS OF TIME AND COURSE OF PREPARING PLANS AND DOCUMENTATION FOR WATER MANAGEMENT AND LAND IMPROVEMENT PROJECTS. (Pol) Wiad. Melior. i Lakarskie. 6(4): 85-90. July/Aug. 1963. 54.8 W86

1751. Dmitriev, I. D. METHODS OF EMPLOYING AEROPHOTOGRAPHY IN AMELIORATIVE FOREST HYDROLOGICAL PROJECTS. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 84-90. 1963. 99.556 P57
Translation from Povyshenie produktivosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the use of aerial photography for drainage design work in the U.S.S.R.

1752. Doddiah, D. DESIGN OF A COMBINED RELIEVING WEIR AND SILT EJECTOR FOR IRRIGATION AND DRAINAGE SYSTEMS. Cong. Irrig. and Drain. Trans. 3(4): 9.277-9.288. 1957. 55.9 C7652

A report was given on the use of a combined relieving weir and silt ejector used in India where drainage canals empties into the irrigation canals. The weir helps in the disposal of excess water and the ejection of silt from the canal.

1753. Donnan, W. W. FIELD INVESTIGATIONS. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agron. 7: 446-459. 1957. 4 Am392

A discussion was given of a field investigation of drainage problems for the design of an adequate drainage system. The four basic elements (topography, soil, water table, and water source) are the key to intelligent field drainage investigations.

1754. Donnan, W. W. DRAINAGE OF AGRICULTURAL LANDS USING INTERCEPTOR LINES. J. Irrig. and Drain. ASCE 85(IR 1): 13-23. Ref. Mar. 1959. 290.9 Am3Ps

Some of the theories regarding the function and behavior of an interceptor drain were given.

1755. Donnan, W. W. TEAMWORK ON DRAINAGE RESEARCH. Soil Conserv. 25(9): 198-200. Apr. 1960. 1.6 So3S

A report was given on the cooperation of the Soil Conservation Service and the Agricultural Research Service for research and application of drainage practices.

1756. Donnan, W. W., and Blaney, H. F. DEVELOPMENT OF A DRAINAGE PLAN FOR AN IRRIGATED AREA. Cong. Internatl. de la Sci du Sol. Rap. 6(D, Comn. VI): 555-560. 1956. 56.09 In8452

A report was given on drainage problems in irrigated areas and factors needed to be considered for the design of drainage systems in the United States.

1757. Donnan, W. W., and Bradshaw, G. B. THE DISPOSAL OF SEEPAGE AND WASTE WATER. U.S. Dept. Agr., Agr. Ybk. 1955: 557-564. 1955. 1 Ag84Y

A report was given on the disposal of seepage and waste water for waters of both good and poor quality.

1758. Donnan, W. W., and Sutton, J. ENGINEERING FOR DRAINAGE. U.S. Dept. Agr., Agr. Ybk. 1960: 113-118. 1960. 1 Ag84Y

A discussion was given on the engineering needs for drainage. Instruments and guides were described for determining the need, design, construction, and mainentance of drainage systems.

1759. Doornbos, J. WHAT ARE THE REQUIREMENTS OF DITCHES? (Du) Netherlands Dir. van de Landb. Verslag van het Landbk. Onderz. in Noordelijk-Groningen. 1957: 101-103. 12 N38Vg

1760. Doubt, P. D. STABILIZED CHANNELS. Agr. Engin. 43(2): 76-77, 85. Feb. 1962. 58.8 Ag83

The methods of permissible velocities, regime theory, and the tractive force theory were applied with varying degrees of intensity for the design and maintenance of stable channels.

1761. Dronkers, J. J. DELTA PROJECT: TIDAL COMPUTATIONS IN COASTAL AREAS. Amer. Soc. Civil Engin. Trans. 125: 1281-1289. 1960. 290.9 Am3

The computation of the tidal motion in shallow coastal waters by means of the so-called harmonic method was given. This method is relatively simple in application. As an example the propagation of the tide in Tampa Bay on the coast of Florida was examined.

1762. Dumm, L. D. TRANSIENT-FLOW CONCEPT IN SUBSURFACE DRAINAGE: ITS VALIDITY AND USE. Trans. ASAE 7(2): 142-146, 151. Ref. 1964. 290.9 Am32T

A discussion was given on the transient-flow concept in subsurface drainage and its validity and use.

1763. Dumm, L. D., and Winger, R. J. SUBSURFACE DRAINAGE SYSTEM DESIGN FOR IRRIGATED AREA USING TRANSIENT-FLOW CONCEPT. Trans. ASAE 7(2): 147-151. 1964. 290.9 Am32T

A report was given on a subsurface drainage system design for irrigated areas using the transient-flow concept.

1764. Duncan, A. A. A METHOD OF JOINING MOLE DRAINS TO EXISTING TILE LINES. New Zeal. J. Agr. 95(4): 376. Oct. 15, 1957. 23 N48J

It is sometimes desirable to use a combination of mole and tile drains in New Zealand. The life of the mole drains are relative short. A system was described for joining new mole drains to existing tile lines.

1765. Dunn, I. S. TRACTIVE RESISTANCE OF COHESIVE CHANNELS. J. Soil Mech. and Found. Div., ASCE 85(SM 3): 1-24. June 1959. 290.9 Am3Ps

A method of estimating the tractive resistance of cohesive channel beds was proposed that used information obtained from simple soil tests (Atterberg Limits, Particle Size Analysis, Vane Borer Tests). The study was made for soil taken from cohesive channels in Colorado, Nebraska, and Wyoming.

1766. Dutt, G. R., and Doneen, L. D. PREDICTING THE SOLUTE COMPOSITION OF THE SATURATION EXTRACT FROM SOIL UNDERGOING SALINIZATION. Soil Sci. Soc. Amer. Proc. 27: 627-630. 1963. 56.9 So3

A procedure utilizing a 1620 IBM computer was developed to predict the concentrations of Ca^{2+}, Mg^{2+}, and Na^+ in saturated extracts from soils undergoing salinization with waters containing Cl^- and $SO_4{}^{2-}$ salts of one or more of the above cations. This procedure was used to predict the concentration in saturated extracts for soils to be salinized with various mixtures of salts. These predicted values were in agreement with experimentally determined values both in systems where the salts remained in solution and where gypsum was precipitated.

This procedure lends itself to routine analysis, and it should be possible to extend it to include other ions and slightly soluble salts that frequently are found in nature.

1767. Dutt, G. R., and Tanji, K. K. PREDICTING CONCENTRATIONS OF SOLUTES IN WATER PERCOLATED THROUGH A COLUMN OF SOIL. J. Geophysical Res. 67(9): 3437-3439. Aug. 1962. 470 J823

A procedure was developed for calculating the concentration of solutes present in waters leached through soils containing gypsum and exchangeable Ca^{++} and Mg^{++}. A program of the procedure, prepared for a 1620 IBM computer, was used to predict the concentration of solutes in the effluent from a Yolo clay-loam soil that was being leached with a 0.025 N $MgCl_2$ solution. The theoretical results were compared with experimentally determined values.

1768. Dzektser, E. S. DRAINAGE OF BOGS WITH DEEP CANALS PLACED FAR APART. (Rus) Gidrotekh. i Melior. 1962(3): 23-28. Mar. 1962. 290.8 G362

1769. Dzhumaniiazov, K. ON TIME OF WATERING FOR LEACHING [SALINE SOILS]. (Rus) Khlopkovodstvo. 5(11): 38-39. Nov. 1955. 72.8 K522

1770. Eaton, F. M. FACTORS TO CONSIDER IN SALT BALANCE STUDIES. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 100-106. Jan. 1958. 55.9 C7693

As knowledge was gained of the effect of excess salt on the well-being of agriculture, the problems of the irrigation and drainage engineers became ever more complex. The need, or justification, of drainage is the removal of not only excess water but of extra water purposefully used to remove salts from the root zone.

1771. Ebert, F. PROPOSAL FOR DRAINAGE OF NORREADALEN. (Da) Hedeselsk. Tidsskr. 81(2): 33-39. maps. Feb. 15, 1960. 11 H35

1772. Ede, A. N. THE HYDRAULIC COMPARISON OF LAND DRAINS AND THE DETERMINATION OF EFFECTIVE DIAMETERS. J. Agr. Engin. Res. 3(1): 9-16. Ref. 1958. 58.8 J82

A report was given on the use of a hydraulic sand tank method in England for making rapid ad hoc comparisons between various drain installation types. The relative discharge data were presented for variously gapped, spaced, and perforated drains.

1773. Ede, A. N. SCHEME FOR THE ASSESSMENT AND DESIGN OF FIELD DRAINAGE SYSTEMS ON A HYDROLOGY BASIS. Internatl. Cong. Soil Sci. Trans. 7(1): 493-506. Ref. 1960. 56.09 In847T

The difficulties in applying rigid design methods to water-table control are connected with assumptions which have to be made as to the steady state, and to the ineffectiveness of permeability measuring methods. To obviate these, a method is being tested of arriving indirectly at figures for the water conducted through inadequately drained fields under known water-table conditions, and the changes in water storage accompanying fluctuations in water-table height. In the subsequent drainage design, the depth of drains allows a definite "buffer" zone in the soil to accommodate the likely peak storms.

1774. Eden, E. W. DESIGN OF MAJOR DRAINAGE CANALS. Amer. Soc. Civil Engin. Proc. Paper 962, 21 pp. May 1956. 290.9 Am3Ps

A report was given on the design of major drainage canals to remove excess flood waters or divert them an alternative more economical outlet. In areas where the ground slope is low, a combined canal and pumping station system is often the best solution. A discussion was given of the design of the Hillsboro Canal in Florida.

1775. Eden, E. W., Jr. HYDROLOGIC AND HYDRAULIC PROBLEMS AS RELATED TO THE DESIGN OF PROJECT WORKS. Soil and Crop Sci. Soc. Fla. Proc. 20: 197-210. 1960. 56.9 So32

A report was given on hydrologic and hydraulic problems in Florida involved in the planning and design of the central and southern Florida Flood Control Project.

1776. Edminster, T. W. AGRICULTURAL DRAINAGE A CONTINUING CHALLENGE. In Hockensmith, R. D. WATER AND AGRICULTURE. Amer. Assoc. Advn. Sci. P. 62, pp. 147-156. Ref. Washington. 1960. 292.9 Am33

A discussion was given of the challenge of drainage through history to the present time. Some of the research projects on drainage were discussed along with some of the new materials and drainage techniques being studied at the present time.

1777. Edminster, T. W., and Schwab, G. O. DRAINAGE IN HUMID AREAS. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agron. 7: 371-394. 1957. 4 Am392

The engineering aspects were given for drainage in humid areas. T. W. Edminster reported on surface drainage and G. O. Schwab reported on subsurface drainage (tile and other lined drains.)

1778. Edminster, T. W., and van Schilfgaarde, J. TECHNICAL PROBLEMS AND PRINCIPLES OF DRAINAGE. U.S. Dept. Agr., Agr. Ybk. 1955: 491-498. 1955. 1 Ag84Y

The search for a theoretical foundation upon which to base field design of drained facilities was discussed. Drainage design will never become an exact science as it always requires sound judgement based on local experience. An understanding of the basic principles, however, can help the field technician in making a more logical and reliable evaluation of the factors involved.

1779. Edwards, D. H. WATER TABLES, EQUIPOTENTIALS, AND STREAMLINES IN DRAINED SOIL WITH ANISOTROPIC PERMEABILITY. Soil Sci. 81: 3-18. 1956. 56.8 So3

Two-dimensional steady-state drainage problems were investigated by the method of electric analogues for a soil whose permeability was anisotropic. Solutions for two values of anisotropy were presented, $K_x/K_y = 10$ and $K_y/K_x = 10$, where K_x and K_y denote, respectively, the horizontal and vertical components of permeability. In each case it was shown: (1) How the height of the water table varied with the rate of rainfall for a particular drain diameter; (2) the manner in which the drain diameter was related to the water-table height for a given rainfall; and (3) how an impermeable bed below the drains influenced the flow. The results were discussed by comparing them with published results for isotropic soils. An analytical solution, which was valid for the hypothetical situation of a plane water table and when K_x was greater than K_y was shown to be in reasonable agreement with the present analogue results.

1780. Einstein, H. A., and Graf, W. H. EXPERIMENTAL APPARATUS STUDIES SEDIMENT TRANSPORT IN CLOSED CONDUITS. Amer. Soc. Civil Engin. Trans. 129: 585-586. 1964. 290.9 Am3

A digest was given of an article written on the experimental apparatus studies of sediment transport in closed conduits. The original article was published in Civil Engin. 33(10): 43-47, Oct. 1963.

1781. El Gibaly, H. SOME STUDIES ABOUT WATER REQUIREMENTS FOR RECLAMATION OF ALKALI SOIL. Cong. Irrig. and Drain. Trans. 4(6): C.437-C.448. 1960. 55.9 C7652

An experiment was reported on the water requirements in Israel for reclaiming black alkali soil. The rates of reclamation depended on gypsum fineness, permeability of soil, kind of water used, and the efficiency of the drainage system. An equation was presented and the results were given for one type of soil.

1782. Elias-Castillo, F., and Gimenez-Ortiz, R. PRECIPITATION AND CAPACITY OF DRAINAGE NETWORKS. (Sp) Spain Inst. Nac. de Invest. Agron. B. 24(50): 103-121. June 1964. 105.6 Sp14
English summary.

A graphical method was given for determining the effect of precipitation on drainage design in Spain by taking into account the detention storage of the field.

1783. Engel, R. E. GOOD DRAINAGE FOR GREENS. USGA J. and Turf Mangt. 12(1): 27-29. Apr. 1959. 60.18 Un32

A report was given on the value of good drainage for golf greens in the United States. Different types of drained suitable for golf courses were discussed.

1784. Engelund, F. THE WATER TABLE IN EQUILIBRIUM WITH RAINFALL OR IRRIGATION WATER. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agron. 7: 113-138. 1957. 4 Am392

The ground water table between two drain pipes forms a curved surface reaching its maximum height approximately midway between two neighboring drains. The methods that have proven particularly valuable to explain the general laws of the flow of water through soils are: (1) Experiments based on electrical analogy; and (2) analytical calculations by means of conformal mapping. Both of these methods were described.

1785. Ennis, R. L. THE CHANGING TECHNIQUES OF FARMLAND DRAINAGE. Service [New Plymouth]. Autumn 1963: 26-27. 1963. 385 Se6

A report was given on the changing techniques of farmland drainage in New Zealand.

1786. Ernst, L. F. THE CALCULATION OF GROUND WATER FLOW BETWEEN PARALLEL OPEN CONDUITS. (Du) Cent. Organ. v. Toegepast-Natwetensch. Onderz. Verslagen van de Tech. Bijeenkomst. 17: 48-68. 1963. 292.9 C33
English summary.

A report was given on the calculation of ground water flow between parallel open ditches in the Netherlands.

1787. Escoffier, F. F. TRANSITION PROFILES IN NONUNIFORM CHANNELS. Amer. Soc. Civil Engin. Trans. 123: 43-56. 1958. 290.9 Am3

If a water-surface profile passes without abrupt change from tranquil to rapid flow, or from rapid to tranquil flow, the point at which it does so lies on a profile that can conveniently be called a "transition profile," and the depth at that point can be termed a "transition depth." Such a profile is fixed in that it does not vary in position with changes in discharge as do normal-depth profiles and critical-depth profiles. Mathematically, the point of transition is a singular point, and the solution to the differential equation for steady flow does not yield the traditional vertical water-surface profile at that point. A graphical practical method for constructing transition profiles was outlined.

With discussion by Messrs. Achille Lazard; Leon J. Tison; and Francis F. Escoffier. pp. 57-65.

1788a. Evans, D. D., and Ashcroft, G. TILE DRAINAGE FOR LAYERED SOIL. Soil Sci. Soc. Amer. Proc. 25(2): 142-145. Mar./Apr. 1961. 56.9 So3

The effect of a restricting layer (1 foot thick) on flow of water to drain tiles was evaluated by the relaxation method using a digital computer to perform the calculation. Drain flux was calculated for each case and compared to give the relative effectiveness of the drains at the selected depths.

1788b. Fang, C. S., and others. THE DESIGN AND CONSTRUCTION OF TERRACES IN THE LOESS PLATEAU OF CHINA. (Ch) Acta Agr. Sinica. 9(1): 14-35. Feb. 1958. 22.5 Ac8
English summary.

A report was given on the design and construction of terraces on the loess plateau of China.

1789. Feichtinger, F. PRESENT STATUS OF DRAINAGE TECHNIQUE IN AUSTRIA. (Ge) Deut. Agrartech. 14(1): 17-18. Jan. 1964. 58.8 D482

1790. Fenzl, R. N., and Davis, J. R. HYDRAULIC RESISTANCE RELATIONSHIPS FOR SURFACE FLOWS IN VEGETATED CHANNELS. Trans. ASAE 7(1): 46-51, 55. Ref. 1964. 290.9 Am32T

Hydraulic resistance relationships were determined for surface flows in vegetative channels (bermudagrass) in Oklahoma.

1791. Ferda, J. CONTRIBUTION TO THE MELIORATION OF SOAKED SOILS. (Cz) Ceskoslov. Akad. Zemedel. Ved. Sborn. Lesn. 34(9): 833-848. Ref. Sept. 1961. 99.9 C334
German summary.

1792. Ferguson, H., and Gardner, W. H. DIFFUSION THEORY APPLIED TO WATER FLOW DATA OBTAINED USING GAMMA RAY ABSORPTION. Soil Sci. Soc. Amer. Proc. 27(3): 243-246. May/June 1963. 56.9 So3

A discussion was given of a diffusion theory applied to water flow data obtained by using gamma ray absorption.

1793. Feuerstein, D. L., and Selleck, R. E. FLUORESCENT TRACERS FOR DISPERSION MEASUREMENTS. Amer. Soc. Civil Engin. Trans. 129: 438-440. 1964. 290.0 Am3

A digest was given on an article written on the study of fluorescent tracers for dispersion measurements. The original article was published in the J. Sanit. Engin. Div., ASAE 89(SA 4): 1-21. Aug. 1963.

1794. Fialkovskii, P. G. THE PROBLEMS OF IMPROVING THE RESEARCH AND PLANNING IN DRAINAGE PROJECTS. (Rus) Gidrotekh. i Melior. 7(11): 21-32. Nov. 1955. 290.8 G362

1795. Fialkovskii, P. G. PRINCIPLES OF MAKING ENGINEERING PROJECTS FOR DRAINAGE SYSTEMS IN AGRICULTURE. (Rus) Moskva, Izdatel'stvo Ministerstva Sel'skokhozyaistvennoi Khozyaistva RSFSR, 1961. 213 pp. Ref. 1961. 290 F442

1796. Fine, L. O. DRAINAGE—SOIL CONSIDERATIONS. Internatl. Seminar Soil and Water Util. Proc. 1962: 208-209. 1962. 56.9 In86

A report was given on soil conditions that must be studied for drainage design work in an irrigated area.

1797. Fine, L. O., Williamson, E. J., Wiersma, F., and Umback, C. R. A STUDY OF THE SODIUM ADSORPTION RATIO AND RESIDUAL SODIUM CARBONATE CONCEPTS OF IRRIGATION WATERS AS THEY AFFECT EXCHANGEABLE SODIUM OF SOIL UNDER SEMIARID CONDITIONS. Soil Sci. Soc. Amer. Proc. 23(4): 263-266. July/Aug. 1959. 56.9 So3

The significance of residual "Na_2CO_3" was studied as engendered by high HCO_3^- content in irrigation water by using synthetic and natural waters in greenhouse experiments, and a natural water in a field experiment. The significance was evaluated in terms of exchangeable Na^+ changes in soils in which the waters were applied.

1798. Fitzsimmons, D. W., and Corey, G. L. A PROCEDURE FOR DETERMINING EQUIVALENT CONDUCTIVITIES OF SOILS FOR ELECTRIC ANALOG SOLUTIONS OF STEADY FLOW PROBLEMS. Idaho Agr. Expt. Sta. Res. B. 58, 11 pp. 1962. 64.9 Id1

Unsaturated flow is essentially a case of flow in a medium whose conductivity varies throughout the medium with the soil-moisture tension; thus, the conductivity-tension relationship for the soil must be known and used in solving unsaturated flow problems. Since the conductivity-tension relationship for a particular soil is generally rather complex, the solution of unsaturated flow problems with analytical or numerical techniques has proved to be very difficult and little attention has been paid to this type of flow. Recently, relatively rapid solutions of steady two-dimensional irrigation and drainage problems have been obtained with electrical analogs using a numerical technique developed by Bouwer and Little (1959) for expressing the conductivity of the soil between any two adjacent network points in terms of the soil-moisture tensions at the points. Much of the tedious work involved in solving unsaturated flow problems by conventional relaxation procedures can be avoided by using this procedure, for the electrical analog automatically relaxes the system.

1799. Flaxman, E. M. CHANNEL STABILITY IN UNDISTURBED COHESIVE SOILS. J. Hydraul. Div., ASCE 89(HY 2): 87-96. Mar. 1963. 290.9 Am3Ps

The erosion resistance of cohesive soils was defined by a comparison of shear strength tests with field observations under specific flow conditions. Samples were obtained by pushing 1.9 inches by 4 inches, thin-walled tubes into undisturbed soils along channel boundaries. Coefficients of permeability were obtained. While still saturated, unconfined compression strength tests were made. Field observations and tests showed that the degree of erosion resistance and shear strength were positively related. Dry density, plasticity index, and percentage of soil finer than 5 microns showed a moderate to high correlation with shear strength, individually and in multiple regression analysis, but failed to explain a majority of the variations. Permeability was better related with the coefficient of correlation $r = -0.78$. This variable reflected the condition that slowly permeable cohesive soils that lose strength by saturation were better able to resist erosion from long duration flows. Shear stresses were symbolized by the product of channel slope, hydraulic radius, specific weight of water, and average velocity, and termed "tractive power."

1800. Flaxman, E. M. CHANNEL STABILITY IN UNDISTURBED COHESIVE SOILS. Amer. Soc. Civil Engin. Trans. 129: 385-387. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a study on channel stability in undistured cohesive soils. The original article was published in the J. Hydraul. Div., ASCE 89(HY 2): 87-96, March, 1963. The references to the discussions and closure were listed.

1801. Flint, S. E. SUBSURFACE DRAINAGE WITH SPECIAL REFERENCE TO TILE DRAINAGE. Austral. Food Mfr. and Distrib. 28(8): 74, 76. Mar. 5, 1959. 389.8 Au7

A report was given on the value of drainage in Australia. The design and use of tile drainage was discussed. Brief mention was made of drainage by tube-well pumping.

1802. Flodkvist, H. ADVICE TO FARMERS PLANNING TO DIG IRRIGATION DITCHES. (Sw) Grundforbattring. 10(3): 180-182. 1957. 54.8 G92
English summary, pp. 200.

Advice was given to farmers in Sweden on field drainage requirement for irrigation and the construction of irrigation ditches.

1803. Flodkvist, H., and Gustafsson, Y. GROUND WATER DISCHARGE OF DRAINAGE SYSTEMS AS FUNCTIONS OF METEOROLOGICAL FACTORS. (Ge) Acta Agr. Scand. 8(3): 231-264. Ref. 1958. 11 Ac82

1804. Fokeev, P. I. DETERMINING DISTANCES BETWEEN HORIZONTAL DRAINS ON IRRIGATED LANDS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 56: 21-26. 1960. 20 M857

1805. Fokkenes, B., and Koning, J. C. De. DRAINAGE IN THE ZUIDERZEE-RECLAMATIONS. Cong. Irrig. and Drain. Trans. 4(2): 11.49-11.63. maps. 1960. 55.9 C7652

A report was given on the drainage requirements for the Ziuderzee reclamations in the Netherlands. Open ditches are first provided and after some years the soil conditions have improved enough so that tile drainage can be used.

1806. Fourie, J. P. CONTOUR SYSTEMS NEED EFFECTIVE PLANNING. Farming So. Africa. 40(7): 35, 37, 39. Oct. 1964. 24 So842

A report was given on the planning and layout of contour banks (terraces) in South Africa.

1807. Francis, C. J. ENGINEERING IN THE SOIL CONSERVATION SERVICE. J. Irrig. and Drain. Div., ASAE 84(IR 1) (1498): 1-13. Jan. 1958. 290.9 Am3Pa

The engineering activities of the Soil Conservation Service to promote sound soil and water conservation programs in the United States were outlined.

1808. Fratric, I. THE INFLUENCE OF WATER VEGETATION ON THE FLOW IN CANALS. (Cz) Vodohospodarsky Casopis. 9(2): 148-159. 1961. 292.8 V85
French summary.

1809. Fujimori, N., and Miyazaki, N. INFLUENCE OF THE CUTTING OF THE PEAT STRATA ON THE GROUND WATER LEVEL. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 14-22. Feb. 1956. 107.6 H68
English summary.

A report was given on the influence of cutting of the peat strata on the ground water level in Japan.

1810. Fujimori, S., Miyamori, N., and Yoshioka, S. RESEARCH CONCERNING SWITCHING FERTILE PEAT RICE PADDY FIELDS. (Ja) Hokuno. 30(8): 12-16. Aug. 1963. 22.5 H683

1811. Fujioka, Y., and Kitamura, T. APPROXIMATE SOLUTION OF A VERTICAL DRAINAGE PROBLEM. J. Geophysical Res. 69(24): 5249-5255. Ref. Dec. 15, 1964. 470 J823

The water potential distribution in soils when the water is draining from a vertical soil column into the atmosphere was studied theoretically and experimentally in Japan. The two kinds of equations, for the quasi-steady state when ponded water on the soil surface is decreasing and for the nonsteady state when the water table disappears from the soil surface and is falling in the vertical soil column were analyzed in detail. There was good agreement between theory and experiment if some special assumptions were accepted.

1812. Fukuda, H. SUBDRAINAGE IN HEAVY SOILS: THEORETICAL CONSIDERATIONS. Soil Sci. 97(4): 281-285. Apr. 1964.

Some theoretical considerations on drainage discharge from tile by which the diameter of the tile could be determined were given for heavy soils.

1813. Gallwitz, K. THE TECHNICAL PROBLEMS OF MECHANICAL DRAINAGE. (Ge) Grundlagen der Landtech. 13: 5-12. 1961. 58.8 G92

1814. Gallwitz, K. ROADS FOR FULLY MECHANIZED DRAINAGE WORK. (Ge) Landtechnik. 19(14): 522-524, 526-527. July 15, 1964. 58.8 L235.

1815. Galvin, L. PILOT SCHEME SHOWS NEED FOR DRAINAGE SURVEY. Farm Res. News. 3(2): 24-26. Mar./Apr. 1962. 10.5 F223

A report was given on the need of a drainage survey for reclamation work in a pilot land project in Ireland.

1816. Ganguli, K. D. RECLAMATION OF THE SALT LAKES NEAR CALCUTTA. East. Econ. 38(20): 1213-1214. May 18, 1962. 280.8 Ea72

A report was given on the reclamation for agricultural purpose of the salt lakes near Calcutta, India.

1817. Garboua, M. CONDITION AND POOR STATE OF DRAINAGE IN THE RHONE DELTA. (Fr) Riz. Rizicult. and Cult. Vivrieres Trop. 4: 149-152. Fourth Q. 1958. 59.8 R52
English summary.

A report was given on the present condition of drainage in the Rhone Delta. It was recommended to replace the open ditches by clay or concrete tile.

1818. Gardner, W. R. SOME STEADY-STATE SOLUTIONS OF THE UNSATURATED MOISTURE FLOW EQUATION WITH APPLICATION TO EVAPORATION FROM A WATER TABLE. Soil Sci. 85(4): 228-232. Ref. Apr. 1958. 56.8 So3

A transformation was given which makes possible the exact solution of some steady-state unsaturated-flow problems and the approximate solutions of some transcient problems.

Steady-state evaporation from a soil in which there is a water table was examined. The maximum evaporation rate was shown to be related to capillary conductivity and depth to water table in a simple fashion.

1819. Gardner, W. R. MATHEMATICS OF ISOTHERMAL WATER CONDUCTION IN UNSATURATED SOIL. Highway Res. Board, Sp. Rpt. 40: 78-87. 1959. 290.9 W733

A study of unsaturated flow problems by the flow equation and its solutions to study the role of various soil and water properties in their influence on water movement were reported. The equation provides means to evaluate the diffusivity and the conductivity.

1820. Gardner, W. R. SOLUTIONS OF THE FLOW EQUATION FOR THE DRYING OF SOILS AND OTHER POROUS MEDIA. Soil Sci. Soc. Amer. Proc. 23(3): 183-187. May/June 1959. 56.9 So3

Numerical solutions of the flow equation for the drying of porous media were obtained by assuming an exponential relationship between diffusivity and water content. Solutions were presented for both semi-infinite and finite media for isothermal conditions, when gravity was absent or negligible.

1821. Gardner, W. R. APPROXIMATE SOLUTION OF A NON-STEADY-STATE DRAINAGE PROBLEM. Soil Sci. Soc. Amer. Proc. 26(2): 129-132. Ref. Mar./Apr. 1962. 56.9 So3

An approximate solution was given of a non-steady-state drainage problem. The theoretical outflow was in good agreement with the results of sand tank and field measurements.

1822. Gardner, W. R., and Brooks, R. H. A DESCRIPTIVE THEORY OF LEACHING. Soil Sci. 83: 295-304. 1957. 56.8 So3

Equations were derived to describe the leaching of soluble salts from soils. The flow process itself, rather than diffusion, was assumed to be responsible both for the diffuse boundary between the soil solution and the leaching water and for the subsequent removal of the bypassed salt.

The theory presented was compared with experimental data obtained from laboratory soil columns and a field plot. Agreement between theory and experiment was found to be satisfactory.

1823. Gardner, W. R., and Hillel, D. I. THE RELATION OF EXTERNAL EVAPORATIVE CONDITIONS TO THE DRYING OF SOILS. J. Geophysical Res. 67: 4319-4325. 1962. 470 J823

Evaporation from laboratory soil columns was studied as a function of potential evaporative conditions. The length of time a given evaporation rate could be maintained by the soil was in good agreement with an approximate solution of the isothermal equation for unsaturated flow. During the falling-rate period of drying, the evaporation rate was found to approach very nearly a function of the water content of the soil and to be nearly independent of the potential evaporation rate. The cumulative evaporation at any time could be calculated from the flow equation. Temporary interruption of the evaporative process had little effect upon the cumulative evaporation over a long period of time.

1824. Gatehouse, H. C. E. PREVENTION OF POLLUTION BY FARM DRAINAGE. Chartered Land Agents' Soc. J. 62(1): 12-22. Jan. 1963. 282.9 L22

A report was given on the prevention of pollution to the river from farm drainage in England.

1825. Gee, H. C. ENGINEERING ASPECTS OF AGRICULTURAL WATER RESOURCES. Soil and Crop Sci. Soc. Fla. Proc. 16: 51-54. 1956. 56.9 So32

A report was given on the need of compentent engineers to assist the farmers in Florida on water control problems of drainage and irrigation.

1826. Gereb, E. A METHOD OF DETERMINING THE LOCATION OF FEEDING VEINS AND STRATA IN WATER-LOGGED AREAS. Cong. Irrig. and Drain. Trans. 4(3): 11.785-11.802. 1960. 55.9 C7652

A report was given on the design of drainage systems in waterlogged areas in Israel by determining the location of feeding veins and strata.

1827. Gibson, A. N. SOIL MOISTURE AS RELATED TO DRAINAGE. J. Soil and Water Conserv. 16(3): 134-135. May/June 1961. 56.8 J822

A comparison was made between rows of 2,000 feet and 500 feet on 0.035 percent slope on Lake Charles clay soil in Texas where surface water was removed and the surface did not pond or impound water. Better moisture conditions prevailed in soils of the greater length under normal and abnormal rainfall in the 35-inch Gulf Coast rainfall belt.

1828. Giudici, P. RECLAMATION AND INTERMITTENT DOWNFLOW. (It) Acqua e il Suolo. 10(5): 511-524. Sept./Oct. 1958. 55.8 Ac7
English summary.

The drainage requirements to reclaim an area with intermittent discharge was studied with and without an expansion reservoir in Italy. Formulas were given to calculate the capacity of the type of drainage system at the critical period of maximum discharge.

1829. Gjefsen, G. FROST INJURIES TO DITCHES. ARE OUR DITCHES TOO SHALLOW? (No) Norsk Landbr. 19, i.e. 20: 438-439. Sept. 26, 1958. 11 N8122

1830. Goins, T. TILE FLOW CHARACTERISTICS. Agr. Engin. 37: 30-32, 35. Jan. 1956. 58.8 Ag83

The effects of controllable factors, such as tile depth, tile spacing, and crop cover, on tile flow were studied. Annual tile flow increased as spacing decreased. The relationship of tile flow by depth and by spacing was altered by rainfall distribution and intensities. Drainage requirements differed by rotation and was a function of the demands of the particular cropping sequence.

1831. Goins, T., and Taylor, G. S. DRAIN DEPTH AND SPACING EFFECTS ON WATER REMOVAL FROM A GRAY-BROWN PODZOLIC SOIL. Soil Sci. Soc. Amer. Proc. 23(6): 413-418. Nov./Dec. 1959. 56.9 So3

The effects were evaluated of two depths (2 and 3 feet) and two spacings (30 and 60 feet) of drains on tile flow rates and drawdown in a glaciated soil in Ohio.

1832. Golding, B. L., and Low, D. E. PHYSICAL CHARACTERISTICS OF DRAINAGE BASINS. J. Hydrol. Div., ASCE 86(HY 3, 2409): 1-11. Mar. 1960. 290.9 Am3Ps

The physical characteristics of drainage basins were reviewed and defined in terms of recent usage. A standard procedure for plotting the area distance curves and area-elevation curves was suggested. A new method developed for computation of a modified area-elevation curve was discussed.

1833. Golding, B. L., and Low, D. E. PHYSICAL CHARACTERISTICS OF DRAINAGE BASINS. Amer. Soc. Civil Engin. Trans. 126(1): 95-105. 1961. 290.9 Am3

The physical characteristics of major significance, such as; area of the drainage-basin, slope of the principal drainage channel, length of the principal drainage channel, shape of the drainage-basin (basin shape), and general slope of the land in the basin (land slope), were reviewed and defined in terms of recent usage. A standard procedure for plotting the area-distance curves and area-elevation curves was suggested. Also discussed was a new method developed for computation of a modified area-elevation curve.

1834. Goncharow, V. N. DYNAMICS OF CHANNEL FLOW. OTS 64-11003. Russian translation. 317 pp. 1964. 292 G583

An English translation was given of the book in Russian on the dynamics of channel flow.

1835. Gondaira, S., Yamamoto, S., and Umeda, Y. ON SWELLING AND DEFORMATION IN DIGGING OPEN CHANNELS AT PEAT-BOGS, TOYOHORO DISTRICT. 1. (Ja) Hokkaido U. Fac. Agr. Mem. 3(1): 1-14. 1958. 107.6 H682
English summary.

As the open channels dug in peat bogs are almost closed in a short time, research of the sources of these phenomena, such as swelling, shrinkage, and deformation in an open channel was made in two experiments. It was recommended that narrow and deep trenches should be made at first and later normal forms of channels should be made.

1836. Goossens, K. J. C. SOME CHARACTERISTICS ON THE RECLAIMING OF PEAT LANDS IN RUANDA-URUNDI. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 43-54. Ref. 1958, pub. 1960. 290.9 C765C
English summary.

Problems relating to the reclaiming of peat lands in Ruanda and Urundi by drainage were discussed. The present method of draining is rapidly degrading the drained swamp soils and it was recommended that the quanity of drainage water be controlled properly.

1837. Gossuin, E. BEST USE OF PRECIPITATION IS ONE OF THE MOST ANCIENT PROBLEMS OF MANKIND. (Fr) Rev. de l'Agr. 10(6): 749-769. June 1957. 13 R322

Descriptions of the methods used in Belgium to solve problems in agricultural hydraulics (principally soil moisture and drainage) were given.

1838. Grasby, J. C., and Watson, J. E. PLAN YOUR OWN CONTOURING. West. Austral. Dept. Agr. J. (ser. 4) 4(1): 4-6, 9-14, 17-19. Jan. 1963. 23 W52J

A report was given on the home construction and use of contours, contour banks (terraces), and diversion banks (diversion terrace) in Australia.

1839. Green, K. D. ECONOMICS OF STRUCTURES IN IRRIGATION AND DRAINAGE CHANNELS. Cong. Irrig. and Drain. Trans. 3(4): 9.29-9.48. 1957. 55.9 C7652

A discussion was given on the economics of structures in irrigation and drainage channels in Australia.

1840. Green, R. E., Hanks, R. J., and Larson, W. E. ESTIMATES OF FIELD INFILTRATION BY NUMERICAL SOLUTION OF THE MOISTURE FLOW EQUATION. Soil Sci. Soc. Amer. Proc. 28(1): 15-19. Jan./Feb. 1964. 56.9 So3

The numerical procedure of Hanks and Bowers was used to solve the moisture flow equation for boundary conditions corresponding approximately to those existing for infiltration into a field soil. Water diffusivity and retention data, necessary for theory calculations of infiltration, were measured on field cores by the outflow method. Infiltration estimates were obtained for a simulated two-horizon soil with three nonuniform antecedent moisture profiles.

Calculated infiltration rates were in good agreement with field rates measured with a sprinkling infiltrometer.

1841. Grereb, E. LOCATING FEEDING VEINS IN WATERLOGGED AREAS. Water Planning for Israel. P.N. 203, 28 pp. Aug. 1960. 54 W29

A report was given on the methods used in Israel for locating feeding veins in waterlogged areas.

1842. Grigor'ev, V. D. NEW DEVELOPMENTS IN PLANNING-AND-PROSPECTING OPERATIONS. (Rus) Lesn. Zhur. 1: 94-98. 1963. 99.8 Sk5

1843. Grover, B. L. NON-STEADY STATE WATER TABLES OF TILE DRAINAGE. Diss. Abs. 20(3): 815. 1959. 241.8 M58

A report was given of a scaled drainage model constructed and verified. The model was made of plexiglass and brass screen cylinders and drains, with glass beads as the porous medium and glycerol as the viscous fluid.

1844. Grover, B. L., and Kirkham, D. A GLASS-BEAD-GLYCEROL MODEL FOR NON-STEADY-STATE TILE DRAINAGE. Soil Sci. Soc. Amer. Proc. 25(2): 91-94. Ref. Mar./Apr. 1961. 56.9 So3

The construction and use of a reduced scale model were described to study the falling water table in non-steady-state tile drainage problems. Stratified soils were simulated.

1845. Grover, B. L., and Kirkham, D. SOLVING TILE DRAINAGE PROBLEMS BY USING MODEL DATA. Iowa Agr. and Home Econ. Expt. Sta. Res. B. 523: 23-48. Ref. Feb. 1964. 100 Io9

A report was given on the use of a glassbead-glycerol model to solve tile drainage problems in Iowa.

1846. Grover, B. L., Ligon, J. T., and Kirkham, D. OPERATIONAL CHARACTERISTICS OF THE LATERALS NEAR THE EDGE OF A TILE DRAINAGE SYSTEM. J. Geophysical Res. 65(11): 3733-3738. Nov. 1960. 470 J823

A two-dimensional scale model was used in a study of the effects of an undrained area, adjacent to a drained area, on the operation of laterals near the edge of a tile drainage system. The discharge from the outside lateral only was increased owing to the undrained area.

1847. Gupta, S. O. P. WATERLOGGING—CAUSES AND REMEDIAL MEASURES THEREFOR. Internatl. Comn. Irrig. and Drain. Annu. B. 1962: 55-63. map. 1962. 55.9 In8A

General problems of waterlogging were discussed. The various causes contributing to waterlogging conditions were analyzed and remedial measures were suggested for India.

1848. Gupta, Y. C. A BETTER DRAINAGE SYSTEM FOR THE N.D.R.I. FARM. Indian Dairyman. 12(6): 169, 189. June 1960. 44.8 In282

A report was given on the design and construction of a better drainage system for the National Dairy Research Institute of India.

1849. Gutierrez-Cortes, H. STANDARDS FOR DRAINAGE FOR WET LANDS OF THE COFFEE-RAISING ZONE. (Sp) Rev. Cafetera de Colombia. 12: 4228-4232. May 1956. 68.28 R32

1850. Guyon, G. SOME NOTES ON THE THEORY OF DRAINAGE AND THE FIRST RESULTS OF EXPERIMENTATION. (Fr) Paris Cent. de Rech. et d'Expt. de Genie Rur. B. Tech. du Genie Rur. 52, 35 pp. Sept. 1961. 58.9 P21

1851. Guyon, G. THE CHARACTERISTICS OF DRAINAGE AND THE CALCULATION OF DIMENSIONS: SPACING AND DEPTH OF DRAINS. (Fr) Paris Cent. de Rech. et d'Expt. de Genie Rur. B. Tech. du Genie Rur. 58, 19 pp. July 1962. 58.9 P21

1852. Guyon, G. CONSIDERATIONS ON THE HYDRAULICS OF DRAINAGE NAPPES THROUGH UNDERGROUND CONDUITS; THEORY AND EXPERIMENTS. Paris Cent. de Rech. et d'Expt. de Genie Rur. B. Tech. du Genie Rur. 65, 45 pp. Ref. Jan. 1964. 58.9 P21
English summary.

A report was given on the hydraulics of drainage for drainage design in France. Design theory and experiments on drainage were reported.

1853. Hague Instituut Van Ingenieurs. CODE OF PRACTICE FOR THE DESIGN OF OPEN WATERCOURSES AND ANCILLARY STRUCTURES. Internatl. Inst. Land Reclam. Impr. B. 7, 80 pp. 1964. 54.9 In8B

A design handbook was given for open watercourses and ancillary structures in the Netherlands.

1854. Hahn, R. H., and Schwab, G. O. TILE SHOW MEASURED ELECTRICALLY. Agr. Engin. 41(12): 822-823. Dec. 1960. 58.8 Ag83

A three-dimensional electric analog model was described for determining tile flow through a two-layered soil.

1855. Hain, A. WHY SHOULD WE SELECT COVERED DITCHES INSTEAD OF OPEN? (Sw) Norrbottens Lantmannabl. 4: 87-90. June 1960. 11 N792

1856. Hakansson, A. DRAINAGE EXPERIMENTS IN SWEDEN. (Sw) Nord. Jordbrforsk. 36: 547-552. 1954. 11 N752

1857. Hakansson, A. STUDIES ON THE INFLUENCE OF TILE DRAIN DEPTH ON GROUND WATER LEVEL, CROP YIELD, DRYING-UP AND TRAFFICABILITY OF THE SOIL. (Sw) Grundforbattring. 13(4): 171-292. maps. Ref. 1960, pub. 1961. 54.8 G92
English summary.

A report was given on the depth of drain tile in Sweden on: (1) Ground water level; (2) crop yield; soil drying; and (4) ability to support equipment.

1858. Hakansson, A. STUDIES ON THE DRAINAGE INTENSITY ON GROUNDWATER LEVEL, YIELD, DROUGHT AND PORTATIVE POWER. (Sw) Uppsala, Almqvist and Wiksells Boktr., 1961. 12 pp. 1961. 54 H12

1859. Hakansson, A. STUDIES ON THE EFFECT OF THE DRAINAGE INTENSITY ON THE GROUNDWATER CONDITION, CROP YIELDS, DRYING OF THE FIELDS AND PORTATIVE POWER. (Sw) Grundforbattring. 14(4): 253-262. 1961. 54.8 G92

1860. Halchias, N. A. THE METHOD OF THE "MINIMUN QUADS", FOR THE EVALUATION OF LAND-SETTLEMENTS TO IRRIGATE BY GRAVITY. (It) Irrigazione. 8(1/2): 44-52. Apr. 1961. 55.8 Ir733
English summary.

An analytical method was given for a rational valuation of irrigation land settlement for land leveling for irrigation in Italy.

1861. Hall, W. A. PERMEABILITY AND INFILTRATION RELATIONSHIPS IN ONE DIMENSIONAL INFILTRATION IN A UNIFORM SOIL. Canad. J. Agr. Sci. 37: 602-604. 1956. 56.8 C162

Equations were developed for the relationship between infiltration rate and time for one dimensional flow in a uniform soil of constant permeability. The depth of ponded water, the permeability of the soil, and the moisture deficit in the transmission zone were the principal parameters. The equations were compared with experimental data with reasonably satisfactory results in view of the restrictive hypotheses.

1862. Hallgren, G. AERIAL PHOTOGRAPHS AS A BASIS FOR DRAINAGE PROGRAMS. (Sw) Jord-Groda-Djur. 12: 23-29. 1956. 11 J763

1863. Hammad, H. Y. A HYDRODYNAMIC THEORY OF WATER MOVEMENT TOWARDS COVERED DRAINS WITH APPLICATION TO SOME FIELD PROBLEMS. Alexandria, Alexandria U. Press. 112 pp. 1957. 54 H18

A detailed report was given on the theory of water movement toward covered drains. Some field problems in Egypt were discussed.

1864. Hammad, H. Y. SEEPAGE LOSSES FROM PARALLEL CANAL SYSTEMS. Amer. Soc. Civil Engin. Trans. 126(1): 136-156. 1961. 290.9 Am3

The two-dimensional problem of steady seepage flow under gravity from a system of parallel, identical, and equally spaced canals into a semi-pervious clay layer of finite thickness underlain by a freely permeable layer of sand and gravel in which the piezometric head is very near the canal water level was discussed. Two steps of conformal mapping were used and an approximation to the canal profile is adopted. In this approximation the specified canal width and depth were not changed.

1865. Hammad, H. Y. DEPTH AND SPACING OF TILE DRAIN SYSTEMS. J. Irrig. and Drain. Div., ASCE 88(IR 1): 15-34. Mar. 1962. 290.9 Am3Ps

The theory of intermittent recharge was extended and analyzed. Equations were presented from which charts may be prepared for easy computation of drain spacings for irrigated agriculture. The analytical results may also be used to compute the effect of natural drainage on the height of the water table as well as anticipated changes in the water table of newly irrigated areas.

1866. Hammad, H. Y. DEPTH AND SPACING OF TILE DRAIN SYSTEMS. Amer. Soc. Civil Engin. Trans. 128(3): 535-554. 1963. 290.9 Am3

The saturation of agricultural soil caused by over-irrigation or rain was investigated. The downward seepage flow through porous soil to a system of parallel tile drains was studied, and a theory of hydrodynamics was developed with the object of providing a scientific basis for the design of tile drains.

Because the seepage flow takes place in planes at right angles to the parallel system of drains, the problem was treated as being two-dimensional. Complex function theory and conformal mapping were used to derive relations among the discharge, head, and spacing of tiles.

The unsteady nature of the seepage flow was taken into account because the water table rises to a maximum height after irrigation or rain, and then falls gradually due to the influence of drainage. A new spacing formula was obtained that was based on the time variation of the water table. This formula gives more economical designs than most of the existing formulas.

The effect of evaporation from the soil surface on the spacing formula was then introduced. This effect alone produces an additional economy of approximately 50 percent. An actual drainage problem was solved by application of the present theory.

With discussion by Messrs. E. J. List; and H. Y. Hammad. pp. 554-560.

1867. Hammad, H. Y. DESIGN OF TILE DRAINAGE FOR ARID REGIONS. J. Irrig. and Drain. Div., ASCE 90(IR 3): 1-15. Sept. 1964. 290.9 Am3Ps

Several points involved in the design of tile drainage systems for irrigated zones were investigated. The distribution of moisture in the capillary zone, the drainage and irrigation requirements, the water table fluctuation, and the depth and spacing of tiles were all studied.

The solution gave a set of equations sufficient for the determination of the different parameters necessary for the design of tile drainage.

1868. Handa, B. K. MODIFIED EATON'S METHODS FOR THE CALCULATION OF GYPSUM AND LEACHING REQUIREMENT OF IRRIGATION WATERS IN ARID REGIONS. Indian Soc. Soil Sci. J. 12(1): 25-28. Mar. 1964. 56.9 In2

A report was given on the modified Eaton's methods for the calculation of gypsum and leaching requirements needed when using irrigation water with sodium and alkali hazards in India.

1869. Hanks, R. J., and Bowers, S. A. NON-STEADY-STATE MOISTURE, TEMPERATURE, AND SOIL AIR PRESSURE APPROXIMATION WITH AN ELECTRIC SIMULATOR. Soil Sci. Soc. Amer. Proc. 24(4): 247-252. June/July 1960. 56.9 So3

An electric simulator was used to approximate the non-steady-state, one-dimensional solution of several moisture, temperature, and air pressure problems in soil. The simulator consists of a resistance-capacitance network with accessory units for setting initial conditions and recording or indicating the simulated variable with time and depth.

1870. Hanks, R. J., and Bowers, S. A. NUMERICAL SOLUTION OF THE MOISTURE FLOW EQUATION FOR INFILTRATION INTO LAYERED SOILS. Soil Sci. Soc. Amer. Proc. 26(6): 530-534. Nov./Dec. 1962. 56.9 So3

A numerical solution of the moisture flow equation was devised and programmed for an IBM 650 computer. Solutions were obtained for infiltration into a loam over a silt loam and vice versa. Solutions were also obtained for vertical upward and vertical downward infiltrations and for horizontal infiltration into two soils.

1871. Hanks, R. J., and Bowers, S. A. TWO-DIMENSIONAL ELECTRIC SIMULATOR FOR NONSTEADY-STATE SOIL MOISTURE FLOW. Soil Sci. Soc. Amer. Proc. 27(2): 240-241. Mar./Apr. 1963. 56.9 So3

The flow of moisture in the soil is a complex process for many conditions the flow equation (diffusion equation)

$$\partial\theta/\partial t = \nabla\cdot D\nabla\theta$$

has been used to advantage to describe this process where θ is volumetric water content, D is diffusivity, and t is time. Solving the flow equation is difficult because it is nonlinear. The authors previously described a one-dimensional electric simulator which has been used to solve the flow equation. This note described a two-dimensional electric simulator and demonstrated the solution of a problem.

1872. Hannigan, M. A. DEPTH OF TILE DRAINS. Queensland Fruit and Veg. News. 9: 726-727. June 7, 1956. 280.38 Q3

A report was given on the need for drainage and depth of placing tile drains for orchards in Australia.

1873. Hantush, M. S. ANALYSIS OF DATA FROM PUMPING TESTS IN LEAKY AQUIFERS. Amer. Geophysical Union Trans. 37: 702-714. 1956. 330.9 Am3

Graphical methods were outlined for determining the coefficients of transmissibility, storage, and leakage of an effectively infinite leaky artesian aquifer. The procedure was based on the theory, developed by Hantush and Jacob, of the nonsteady flow toward a steadily discharging well from an infinite leaky aquifer. Applications of these methods were illustrated by treating data from the Roswell artesian basin in New Mexico.

1874. Hantush, M. S. NONSTEADY FLOW TO FLOWING WELLS IN LEAKY AQUIFERS. J. Geophysical Res. 64(8): 1043-1052. Ref. Aug. 1959. 470 J823

Potential distribution was found for a flowing well discharging by natural flow from a uniform aquifer into, and/or out of, which there is leakage in proportion to the drawdown. The leaky aquifer was of uniform compressibility and of uniform transmissibility. Three cases were considered: (1) That of a well draining an infinite leaky aquifer; (2) that of a well at the center of a circular aquifer with zero drawdown on its outer boundary; (3) that of a well situated at the center of a closed circular aquifer (that is, the flow across the outer boundary is zero). The variation of the discharge with time is formulated in the three cases.

1875. Hantush, M. S. ANALYSIS OF DATA FROM PUMPING WELLS NEAR A RIVER. J. Geophysical Res. 64(11): 1921-1932. Ref. Nov. 1959. 470 J823

Methods were outlined for determining the hydrologic characteristics of an aquifer draining or drained by a stream; specifically, for determining the transmissibility and storage coefficient of the aquifer and also the effective distance from a pumped well to a line in the stream bed where the water is entering or leaving the aquifer. The procedure is based on the theory of nonsteady flow toward a well steadily discharging from an infinite aquifer hydraulically connected to a fairly straight and long stretch of a stream bed. Application of these methods was illustrated by treating data from the Ingalls area in Kansas.

1876. Hantush, M. S. MODIFICATION OF THE THEORY OF LEAKY AQUIFERS. J. Geophysical Res. 65: 3713-3725. 1960. 470 J823

The theory of leaky aquifers as currently known involves among other things the assumption that the storage in the semipervious layers is small and may be neglected. Frequently, the semi pervious beds, although of very low permeabilities, may yield significant amounts of water from storage. Flow systems in which the storage in the semiconfining layers was taken into consideration was reported. These general solutions gave a more exact description of the actual flow system.

1877. Hantush, M. S. DRAINAGE WELLS IN LEAKY WATER-TABLE AQUIFERS. Amer. Soc. Civil Engin. Trans. 128(1): 1005-1009. 1963. 290.9 Am3

Flow formulas were found for a well draining a water-table aquifer that overlies a semipervious layer through which leakage takes place from or into an underlying permeable strata in which the hydraulic head remains uniform. The leaky water-table aquifer is replenished by vertical percolation due to excess irrigation or leaching or both. A function depending on two parameters is tabulated in order to simplify calculations leading to the determination of the appropriate well discharge and spacing. An expression for the time required to lower the water table to a new desirable elevation is also obtained.

1878. Haret, C. CONSIDERATION ON THE DRAINAGE DEPTH ON THE CONDITIONS IN OUR COUNTRY. (Rum) Prob. Agr. [Bucuresti] 10(1): 45-53. Ref. Jan. 1958. 21 R862

1879. Harris, W. S. WARPED SURFACE STUDIES IN THE DELTA. Ark. Farm Res. 13(2): 7. Mar./Apr. 1964. 100 Ar42F

A report was given on the use of warped surfaces for surface drainage in the Delta.

1880. Harris, W. S., Benedict, R., and Wait, J. USING COMPUTERS AS A TOOL IN LAND GRADING. Ark. Farm. Res. 11(4): 9. 1962. 100 Ar42F

A program was developed for IBM 650 Electronic Computer for solving land grading problems. Using this program, the computer solves problems in warped surface design—that is, surfaces with row grades and side slopes varying within prescribed limits.

This computer program should result in designs for warped surfaces that will satisfy requirements for drainage and irrigation. These designs will require near minimum volumes of cuts and fills and near minimum haul distances.

1881. Harrison, D. S. DRAINAGE CRITERIA FOR FLATWOODS CITRUS. Citrus Indus. 41(7): 5-6. July 1960. 80 C49

A report was given on the design criteria and use of tile and perforated pipe drainage of flatwood citrus areas in Florida.

1882. Harrison, D. S., Stewart, E. H., and Spier, W. H. SOME CONSIDERATIONS FOR DRAINAGE OF FLATWOODS SOILS USED IN VEGETABLE PRODUCTION. Fla. State Hort. Soc. Proc. 73: 195-200. 1960, pub. 1961. 81 F66

A report was given on the design of drainage systems of flatwoods soils in Florida used for vegetable production.

1883. Hazan, R. EVACUATION OF SURFACE RUNOFF AND DRAINAGE WATERS BY MEANS OF INJECTION INTO THE AQUIFER. (Fr) Cong. Irrig. and Drain. Trans. 5(6): R.18.161-R.18.168. map. 1963. 55.9 C7652
English summary.

A report was given on the use of drainage waters and surface runoff in Morocco by injecting them into the aquifer.

1884. Heikurainen, L. DEPTH AND SPACING OF FOREST DITCHES. II. (Fi) Metsataloudellinen Aikakauslehti. 1957(7/8): 233-238. Ref. 99.9 F49
English summary.

Results of various studies were reviewed that illustrated the desirable depth and spacings of forest ditches in Finland.

1885. Henderson, F. M. STABILITY OF ALLUVIAL CHANNELS. Amer. Soc. Civil Engin. Trans. 128(1): 657-658. 1962. 290.9 Am3

A report was given on the use of different theories on the study of the stability of alluvial channels.

With discussion by Messrs. T. Blench; Gerald Lacey; D. B. Simons; T. M. Prus-Chacinski; Claude C. Inglis; and Francis M. Henderson. pp. 686-720.

1886. Henderson, F. M., and Wooding, R. A. OVERLAND FLOW AND GROUNDWATER FLOW FROM A STEADY RAINFALL OF FINITE DURATION. J. Geophysical Res. 69(8): 1531-1540. Ref. Apr. 15, 1964. 470 J823

The buildup and decay of a laminar or turbulent flow over a sloping plane was treated by the kinematic-wave method, neglecting the slope of the water surface relative to the slope of the plane. The relationships developed showed certain distinct differences from those postulated in the unit hydrograph method. However, a comparison of the results of calculations with published experimental measurements shows quite good agreement. The problem was extended to include the case of ground water flow through a porous medium overlying a sloping impermeable stratum, where water is supplied by infiltration from the ground surface above.

1887. Henderson, J. M., AGRICULTURAL LAND DRAINAGE AND STREAM POLLUTION. J. Sanitary Engin. Div., ASAE 88(SA 6): 61-74. Nov. 1962. 290.9 Am3Ps

The effect of animal manures in agricultural land drainage on stream pollution was discussed for the Potomac River drainage shed above Washington, D.C.

1888. Henderson, J. M. AGRICULTURAL LAND DRAINAGE AND STREAM POLLUTION. Amer. Soc. Civil Engin. Trans. 128(3): 335-348. 1963. 290.9 Am3

The inherent characteristics of organic pollution contributed to agricultural land drainage by farm animals were investigated as well as whether this contribution can be a significant problem in stream pollution. The nature of abatement measures was outlined, together with their practicability and effectiveness. Human disease hazards in water-borne animal wastes were reviewed. The Potomac River drainage shed above Washington, D.C., was used as a case example. Calculations for the cited portion of the Potomac River drainage shed indicate that in 1959 the raw waste of farm animals had a population-equivalent (PE) of over 3 million, applied to land surfaces. This PE was over 8 times that of the total human population on a human excrement basis and 4.5 times the raw domestic sewage PE. Limited data were cited concerning the actual BOD contribution of agricultural land drainage to a stream under flushing-flow conditions.

1889. Herfeld, T. AUTOMATIC DEPTH REGULATION IN DRAINS. (Ge) Ubersicht. 13(1): 21-24. Jan. 10, 1962. 18 Ub3

1890. Herfeld, T. AUTOMATIC DEPTH REGULATION IN DRAINAGE. (Ge) DLZ—Deut. Landtech. Z. 13(2): 63-64, 66. Feb. 1962. 58.8 T677

1891. Hermsmeier, L. F., and Larson, C. L. LAND FORMING: GRADE AND ROW-LENGTH STUDIES IN THE RED RIVER VALLEY. Trans. ASAE 5(2): 172-174, 179. 1962. 290.9 Am32T

Grade and row-length studies were reported on land forming in the Red River Valley of Minnesota and North Dakota.

1892. Herndon, L. W. DRAINAGE IN THE MISSISSIPPI RIVER VALLEY. J. Irrig. and Drain. Div., ASCE 83(IR 2, 1363), 11 pp. Sept. 1957. 290.9 Am3Ps

A report was given on a cooperative drainage project in the alluvial valley of the Mississippi river. The relation of flood control to drainage was discussed and the different elements of a complete surface drainage system were described.

1893. Hewlett, J. D., and Hibbert, A. R. MOISTURE AND ENERGY CONDITIONS WITHIN A SLOPING SOIL MASS DURING DRAINAGE. J. Geophysical Res. 68: 1081-1087. 1963. 470 J823

In an effort to explain the source of nonstorm streamflow in deep-soiled areas of the southern Appalachians, a 3 x 3 x 45-foot inclining concrete trough was constructed on a 40 percent slope. The structure was packed with a natural sandy-loam soil to a bulk density of 1.3, and after thorough soaking was covered with plastic to prevent evaporation. Outflow was measured at the base, and soil moisture tension and content were recorded for 145 days.

1894. Heyndrickx, G. A. HYDRAULIC DESIGN OF PIPE AND TILE DRAINS. General Report. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 72-82. 1958, pub. 1960. 290.9 C765C
English summary.

A general report was given on the present knowledge and needs of hydraulic design data for pipe and tile drains.

1895. Hill, R. A. LEACHING REQUIREMENTS IN IRRIGATION. J. Irrig. and Drain. Div., ASCE 87(IR 1, 2757): 1-5. Mar. 1961. 290.9 Am3Ps

Formulas were developed for leaching requirements for irrigation related to the functions to be formed and the salinity of the applied waters.

1896. Hills, R. S. DRAINAGE CANALS PLANNED THROUGH FEASIBILITY STUDY. Pub. Works. 94(9): 100-103. Sept. 1963. 290.8 M922

A report was given of the value of a feasibility study for drainage design for drainage channels in a county of South Carolina.

1897. Hinesly, T. D. SHAPE OF THE WATER TABLE WHERE STEADY RAINFALL SEEPAGE INTO DRAINS IS REINFORCED BY ARTESIAN WATER. Diss. Abs. 22(8): 2531. Feb. 1962. 241.8 M58

An abstract was given of a theoretical investigation of the problem of drainage when steady rainfall or irrigation water seeps into drains of various types and sizes is reinforced by simultaneous upward seepage of artesian water. Two solutions to the problem were derived and discussed.

1898. Hino, M. TURBULENT FLOW WITH SUSPENDED PARTICLES. Amer. Soc. Civil Engin. Trans. 129: 266-267. 1964. 290.9 Am3

A digest was given of a study of turbulent flow with suspended particles. The original article was published in the J. Hydraul. Div., ASCE 89(HY 4): 161-185, July, 1963.

1899. Hodgkin, B. M. WATER MUST BE JUST RIGHT. Com. Grower. 1957(3217): 371, 373. Aug. 30, 1957. 80 F941

A report was given on water management for orchards. A discussion was included on the needs and types of drainage for orchards.

1900. Hoff, P. R., Aglibut, A. P., and De Padua, D. THE DESIGN, INSTALLATION, AND PERFORMANCE OF AN UNDER-DRAINAGE SYSTEM IN THE CENTRAL EXPERIMENT STATION. Soil Sci. Soc. Philippines J. 8: 12-18. First Q. 1956. 56.9 So35

The design, installation, and performances of closed drains at the Central Experiment Station in the Philippines were given.

1901. Hoffman, G. J., and Schwab, G. O. TILE SPACING PREDICTION BASED ON DRAIN OUTFLOW. Trans. ASAE 7(4): 444-447. 1964. 290.9 Am32T

A report was given on a method of prediction of tile spacing from a drain outflow study in Ohio. Surface drainage increased the permissible tile spacing by over 50 percent.

1902. Hommik, K. HYDROLOGICAL PRINCIPLES OF DESIGNING DRAINAGE SYSTEMS. (Es) Akad. Nauk Estonskoi SSR. Izv. 5(2): 123-138. 1956. 511 Ak19
German summary.

1903. Hoorn, J. W. Van. FUNDAMENTAL PRINCIPLES OF FIELD DRAINAGE. (Fr) Internatl. Comn. Irrig. and Drain. Annu. B. 1964: 59-94. map. Ref. 1964. 55.9 In8A
English summary.

A report was given on the fundamental principles of field drainage in the Netherlands for the design of drainage systems.

1904. Hopewell, H. G. SOIL MOISTURE MEASUREMENTS IN RELATION TO SOIL DRAINAGE RESEARCH. New Zeal. Dept. Sci. and Indus. Res. Inform. Ser. 12: 78-81. 1954, pub. 1956. 464.9 N48

A report was given on the use of soil moisture measurements for drainage research in New Zealand. Some comments were made on the influence of soil drainage on pasture production.

1905. Hore, F. R., and Gray, D. M. AN EVALUATION OF SOME TILE-DRAIN DEPTH AND SPACING FORMULAE FROM THE PHYSICAL PROPERTIES OF SOME ONTARIO SOILS. Canad. J. Soil Sci. 37(2): 120-127. Ref. Aug. 1957. 56.8 C162

Some physical properties from six soil types at two locations in Canada were used to solve and evaluate formulas for the depth and spacing of drain tile proposed by Hooghoudt, Walker, Slater, and Dumm. None of the formula results of spacing agreed precisely. Causes for discrepancies between the results were shown to be due to technical differences in applying data to the formula and to inherent differences in derivation of the formula.

1906. Hore, F. R., Irwin, R. W., Matthews, B. C., and Parrish, F. J. DRAINAGE GUIDE FOR ONTARIO. Ontario Dept. Agr. P. 29, 24 pp. Sept. 1960. 7 On8P

A guide was given for the design and construction of farm drainage systems in Ontario, Canada.

1907. Horth, C. J. ORCHARD DRAINAGE. New South Wales Dept. Agr. Div. Hort. Syndey, 1955. 23 pp. 1955. 54 N42

The design and use of tile drainage for orchards and vineyard were given for New South Wales.

1908. Hosoyamada, K. STUDIES ON THE RECLAIMED LAND DIKE FROM THE STANDPOINT OF AGRICULTURAL ENGINEERING. I. THE MODEL EXPERIMENTS ON THE WIND FLOW CROSSING OVER THE RECLAIMED LAND DIKE BY USING WATER-FLOW THROUGH A LONG CHANNEL. (Ja) Yamaguti U. Faculty Agr. B. 10: 1263-1272. Ref. 1959. 107.6 Y14
English summary.

Experiments were reported of testing wind flow over a model reclaimed land dike by using water flow through a long channel in Japan.

1909. Hosoyamada, K. STUDIES ON THE RECLAIMED LAND DIKE FROM THE STANDPOINT OF AGRICULTURAL ENGINEERING. II. THE EXPERIMENTS ON THE TURBULENT DIFFUSION COEFFICIENT OF THE AIR FLOW AND THE SURFACE WATER FLOW THROUGH A LONG CHANNEL. (Ja) Yamaguti U. Faculty Agr. B. 10: 1273-1282. Ref. 1959. 107.6 Y14
English summary.

Experiments were reported on testing the turbulent diffusion coefficient of air-flow and surface water flow through a long channel in Japan by the use of a smoke tube and ink.

1910. Hosoyamada, K. STUDIES ON THE RECLAIMED LAND DIKE FROM THE STANDPOINT OF AGRICULTURAL ENGINEERING. III. THE PERCOLATION EXPERIMENT ON THE ANALOGUE MODEL DIKE. (Ja) Yamaguti U. Faculty Agr. B. 11: 83-88. 1960. 107.6 Y14
English summary.

Studies were reported of a percolation experiment on an analogue model dike in Japan. Methods were given of improving and measuring of a model dike.

1911. Hosoyamada, K. ON THE PERCOLATION THROUGH A MODEL DIKE. II. STREAM LINE, STREAM VELOCITY, DISCHARGE AND CAPILLARY POTENTIAL. (Ja) Agr. Engin. Soc. (Japan) Trans. 4: 41-46. Mar. 1962. 290.9 Ag8
English summary.

Results were given of a study in Japan on the results of the streamline, stream velocity, discharge, and capillary potential in percolation through a model dike.

1912. Houston, C. E. DRAINAGE OF IRRIGATED LAND; IT'S EXPENSIVE BUT CAN PAY OFF HANDSOMELY. II. World Farming. 5(8): 36-41, 47. map. Aug. 1963. 30.08 W89

A report was given on the design and need of drainage systems in California.

1913. Houston, C. E. DRAINAGE OF RECREATIONAL AREAS. Calif. Turfgrass Cult. 14(2): 14-15. Apr. 1964. 60.18 So8

A report was given on the need and use of drainage for turf on recreational areas.

1914. Hulsbos, W. C., and Boumans, J. H. LEACHING OF SALINE SOILS IN IRAQ. Netherlands J. Agr. Sci. 8: 1-10. 1960. 12 N3826

A large proportion of the soils of the Lower Mesopotamian Plain are very saline. Some data were presented on the salt movement in the top-soil and the overall discharge of salt from the area. It was concluded that, even with intensive drainage and leaching operations, the sub-soil water and the drain water will remain salty for a very long period.

A leaching curve was constructed on the basis of field experiments on the Dujailah Experimental Farm. The curve was compared with a curve for Annanah soils and a curve for a Utah soil. The limits and the use of the curve were explained. With the aid of this leaching curve and the data on the salinity before leaching, the amount of water needed to obtain any required salinity level in the soil can be calculated. To facilitate the calculations, a leaching graph has been constructed to show the drain-water depth per unit depth of soil as a function of the salinity before leaching and of three different levels after leaching.

1915. Hunt, H. F., Sweet, R. L., and Larsen, H. L. LITTLE ROBBER DIKE SYSTEM. Wyo. Agr. Expt. Sta. Wyo. Range Mangt. 92, 3 pp. Apr. 1956. 60.19 W99

A report was given on a dike system of drainage for the Little Robber drainage area in Wyoming. The program consists on a detention dam, with control gate above the dike system; a diversion dam and 300 acres of dikes; and 4 detention structures within the upper limits of the drainage.

1916. Iakovlev, B. I. IN REGARD TO RECLAMATION OF HOLLOWS ON RICH LOESS SOILS. (Rus) Belorusskaia Sel'skokhoz. Akad. Trudy 21: 167-175. 1955. 106 B415

1917. Ibragimov, S. DATES, METHODS AND NORMS FOR LEACHING OF SALTY SOILS UNDER THE CONDITIONS OF THE KHOREZM REGION. (Rus) Tashkent. Nauch.-Issled. Inst. po Khlopkov. Sborn. Nauch. Rabot Aspirantov SoyuzNIKHI 3: 130-137. 1962. 72.9 T182Sb

1918. Ignatenok, F. V. MATERIAL DRAINAGE WITHOUT TRENCHES. (Rus) Belorusskaya Sel'skokhoz. Akad. Trudy 35: 124-134. 1961. 106 B415

1919. Ignatenok, F. V. A HYDRAULIC COMPUTATION ON DRAINS OF THE NEW DESIGN. (Rus) Belorusskaya Sel'skokhoz. Akad. Trudy 35: 135-141. 1961. 106 B415

1920. Ionat, V. A. COMPUTATION ON INADEQUATE DRAINAGE SYSTEM IN PEAT SOILS. (Rus) Moscow Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy 37: 167-175. 1962. 292.9 M85

1921. Iovenko, N. G. DETERMINATION OF THE SPECIFIC WATER DISCHARGE OF SOILS. (Rus) Pochvovedenie 3: 110-116. Ref. Mar. 1957. 57.8 P34
English summary.

The mean values for specific water discharges of salinized medium and heavy loam soil of Russia were given for calculating the drainage systems for leaching the soils. For these soils it was necessary to combine the leaching with deep plowing and shallow covered drains.

1922. Iowa Agricultural Experiment Station. IOWA DRAINAGE GUIDE. Iowa State Col. Agr. Ext. Spec. Rpt. 13, 28 pp. Sept. 1955. 100 Io9Sp

A detailed drainage guide was given for surface and subsurface drainage in Iowa. Recommended spacings and depth of tile was given for the different soil types in Iowa.

1923. Ippen, A. T., and Drinker, P. A. BOUNDRY SHEAR STRESSES IN CURVED TRAPEZOIDAL CHANNELS. Amer. Soc. Civil Engin. Trans. 129: 55-57. 1964. 290.9 Am3

A digest was given of an article, discussion, and the closure on the distribution and magnitudes of boundary shear stresses in the curved reaches of smooth trapezoidal channels under conditions of subcritical flow. The original article was published in J. Hydraul. Div., ASAE (HY 5): 143-179. Sept. 1962. References to the discussions and closure were listed.

1924. Isherwood, J. D. WATER-TABLE RECESSION IN TILE-DRAINED LAND. J. Geophysical Res. 64(7): 795-804. July 1959. 470 J823

A high-speed digital computer was programed to obtain water-table recession in homogeneous tile-drained soil. Parameters considered were tile depth, spacing, barrier depth, hydraulic conductivity, and drainable pore space. Drain diameter was six inches. The midpoint water-table height was found to fall exponentially with time after a slower initial rate. Results presented graphically can be used for the rapid evaluation of the effectiveness of two drains. Tile spacing for any given surface drawdown rate can then be determined.

1925. Isherwood, J. D., and Pillsbury, A. F. SHALLOW GROUND WATER AND TILE DRAINAGE IN THE OXNARD PLAIN. Amer. Geophysical Union Trans. 39(6): 1101-1110. maps. Ref. Dec. 1958. 330.9 Am3

A report was given on the study of shallow ground water in California by the use of a network of prezometers 10 and 20 feet below the surface. Twenty-two percent of the water applied was discharged from tile line as waste.

1926. Israelsen, O. W., Milligan, C. H., and Bishop, A. A. NEEDS FOR AND METHODS OF DRAINAGE; LOGAN, HYDE PARK, BENSON AREA, UTAH. Utah Agr. Expt. Sta. Spec. Rpt. 11, 27 pp. Ref. Nov. 1955. 100 Ut1Sp

A report was given on the needs and use of drainage in Cache Valley, Utah.

1927. Ivitskii, A. I. CALCULATIONS FOR PLANNING OF DRAINAGE SYSTEMS IN POLESYE. (Rus) Moskva. 30 pp. 1957. 54 Iv50

1928. Ivitskii, A. I. INVESTIGATION OF SWAMP-DRAINING NORMS. 19 pp. Ref. (OTS 63-11018) Transl. 13511
Translation from Akademiya Nauk Belorusskoi SSR. Institut Melioratsii, Vodnogo i Bolotnogo Khozyaistva. Trudy 8: 35-54. 1958.

Investigations were reported on swamp-drainage norms in the U.S.S.R. for the design of drainage systems.

1929. Ivitskii, A. I. PRINCIPLES OF UNDERDRAINAGE DESIGN IN THE BELORUSSIAN SSR. Jerusalem, Israel Program for Scientific Translations, 90 pp. 1960. 541 V5Ae

A discussion was given of the principles of drainage design for the Belorussian S.S.R.

1930. Ivitskii, A. I. METHODS FOR THE RECLAMATION OF SWAMPS. (Rus) United Nations Conf. Appl. Sci. and Technol. Benefit Less Developed Areas. Working Papers, Agr., v. 9, No. 432, 10 pp. Ref. Nov. 1, 1962. (E/Conf. 39/C/432) 281.9 Un392
English summary, (2).

A report was given on the research in Russia of depth of drainage for the reclamation of peat in swamps for various types of crops.

1931. Ivitskii, A. I. A NEW APPROACH TO THE DETERMINATION OF RATE OF DRAINAGE UNDER MELIORATION. (Rus) Akad. Nauk Belorusskoi SSR. Dok. 6(12): 795-797. Dec. 1962. 511 M663D

1932. Ivitskii, A. I. MAXIMUM AND OPTIMUM RATES FOR DRAINING OF SWAMPS. (Rus) Gidrotekh. i Melior. 12: 33-42. Ref. Dec. 1962. 290.8 G362

1933. Iwasa, Y. ATTENUATION OF SOLITARY WAVES ON A SMOOTH BED. Amer. Soc. Civil Engin. Trans. 124: 193-206. 1959. 290.9 Am3

The hydraulic characteristics of solitary waves were examined. Special consideration was given to the mathematical analysis of the attenuation process of solitary waves. Then the theoretical results were compared with experimental data. It was found that the total kinetic energy minus the potential energy was twice the kinetic energy of the vertical motion.

1934. Iwata, S. ON FIELD CAPACITY. (Ja) Nogyodoboku-Kenkyu. 30(7): 9-18. Ref. Mar. 1963. 290.8 N68
English summary.

The relationships between layer conditions of soils and the hydraulic gradient changes with time during drainage were investigated in Japan.

1935. Jacobson, P. A FIELD METHOD FOR STAKING CUT AND FILL TERRACES. Agr. Engin. 42(12): 684-687. Dec. 1961. 58.8 Ag83

A field method was given for reducing point rows without the use of maps or profile plotting for stacking cut and field terraces.

1936. Jager, A. W. De. DRAINAGE IN VEGETABLE AND FRUIT CULTURE. (Du) Groenten en Fruit. 16(43): 1506-1507, 1509. Apr. 27, 1961. 80 G89

1937. Jager, A. W. De, and Haaijer, B. M. TRANSPORT OF SAND AND SILT IN DRAINS. (Du) Nederland. Heidemaatsch. Tijdschr. 74(5): 151-159. May 1963. 12 N282

1938. Jager, A. W. De, and Haaijer, B. M. TRANSPORT OF SAND AND SILT IN DRAINS. (Du) Nederland. Heidemaatsch. Tijdschr. 74(7/8): 286-287. July/Aug. 1963. 12 N282

1939. Jarocki, W. HYDROLOGIC AND HYDRAULIC COMPUTATIONS OF CULVERTS AND SMALL BRIDGES. Off. Tech. Serv. OTS 60-21508. 160 pp. 1963.

A translated reprint of the book: "Hydrologic and Hydraulic Computations of Culverts and Small Bridges" published by Wydawnictwa Komunikacyjne, Warszawa, Poland, in 1953 was given.

1940. Jen, Y. M. RESEARCH INTO THE EXTERNALS AND SPECIFICATIONS OF THE DRAINAGE ARRANGEMENTS FOR PADDY RICE FIELDS WITH ALKALI SOILS ON THE SEA COAST. (Ch) Turang Tongbao. 2: 25-29. 1964. 56.8 T792

1941. Jesenak, J. DRAINAGE OF SOILS WITH THE HELP OF UNDER PRESSURE. (Cz) Vodohospodarsky Casopis. 9(1): 62-80. Ref. 1961. 292.8 V85
German summary.

1942. Jobin, W. R., and Ippen, A. T. ECOLOGICAL DESIGN OF IRRIGATION CANALS FOR SNAIL CONTROL. Sci. 145(3638): 1324-1326. Sept. 18, 1964. 470 Sci2

A report was given on the design of irrigation and drainage canals to dislodge the fresh water snails and prevent their growth and spread in tropical countries.

1943. Joglekar, D. V. CONTROL OF SAND ENTERING CANALS. Irrig. and Power. 16(2): 177-190. map. Apr. 1959. 55.9 In222C

A report was given on the control of sand entering canals from a channel carrying sediment load in India. Preventive and curative method of sand control were discussed.

1944. Johnson, E. A., and Dils, R. E. OUTLINE FOR COMPILING PRECIPITATION, RUNOFF, AND GROUND WATER DATA FROM SMALL DRAINAGE AREAS. U.S. Forest Serv. Southeastern Forest Expt. Sta., Sta. Paper 68, 40 pp. Aug. 1956. 1.9622 S4St2

Basic inventory methods were given that were used for the systematic compilation of data on precipitation, streamflow, and ground water on a small drainage area at the Coweeta Hydrologic Laboratory in North Carolina.

1945. Johnson, H. P. EFFECT OF MISALIGNMENT ON CAPACITY OF TILE FLOWING FULL. (Abs.) Engin. 40(3): 169. Mar. 1959. 58.8 Ag83

Laboratory tests were conducted on model tile to determine the effect of different degrees of misalignment and length-to-diameter ratios on the capacity of the tile.

Observations indicated that the mean value of a series of measured misalignments will result in the same resistance to flow at the same Reynolds number as a constant misalignment of the same magnitude as the mean.

1946. Jones, B. A. STUDY OF THE EFFECT OF CRACK WIDTH AT TILE JOINTS ON SOIL MOVEMENT INTO DRAIN TILE LINES. Diss. Abs. 19(5): 1038. Nov. 1958. 241.8 M58

A discussion was given on the effect of the crack width at tile joints on soil movement into tile lines in Illinois on sandy loam, silt loam, and silty clay loam soils.

1947. Jones, B. A. THE EFFECT OF CRACK WIDTH AT TILE JOINTS ON SOIL MOVEMENT INTO DRAIN TILE LINES. (Abs.) Agr. Engin. 40(3): 168. Mar. 1959. 58.8 Ag83

A laboratory procedure to determine the effect of the crack width at tile joints on the quantity of soil moved into tile drains was described. Three sizes of crack widths were used and tested with a sandy loam, a silt loam, and a silty clay loam.

1948. Jones, B. A. EFFECT OF CRACK WIDTH AT TILE JOINTS ON SOIL MOVEMENT INTO DRAINTILE LINES. Trans. ASAE 3(1): 33-35, 41, 54. 1960. 290.9 Am32T

The effect was reported of crack width at tile joints on soil movement into drain tiles in a laboratory experiment.

1949. Kadir, A. DRAINAGE DEVELOPMENT AND PROBLEMS IN IRAQ. Near East-S. Afr. Irrig. Pract. Seminar. [Proc.] 5:229-238. map. 1964. 173.2 In8Reg

A report was given on drainage problems in Iraq and the design and use of drainage to solve these problems.

1950. Kalisvaart, C. SCIENTIFIC RESEARCH: THE BASIS OF THE RECLAMATION AND DEVELOPMENT OF THE IJSSELMEER POLDERS. (Du) Van Zee tot Land. 39: 189-205. Ref. 1964. 54.8 V26
English summary.

A report was given on the use of research for the basic of reclamation and development of the IJsselmeer polders in the Netherlands.

1951. Kalisvaart, C., and Prummel, B. RESEARCH—AN "INDUSTRY WITHIN THE UNDERTAKING." Van Zee Tot Land. 36: 7-11. 1963. 54.8 V26

Some facets were given of the research-work necessary for the reclamation and cultivation of recently drained polders in the Netherlands.

1952. Kano, T., Nakagawa, S., Onishi, H., Maruyama, T., Furuki, T., and Kamimura, M. STUDIES ON THE DESIGN OF DRAINAGE FROM SWAMPY PADDY-FIELD. I. (Ja) Tokyo Natl. Inst. Agr. Sci. B. Ser. F (Agr. Engin.) 13: 1-103. Mar. 1961. 290.9 T57
English summary.

Studies were reported on subsurface drainage tests from 1956-59 in Japan to help design a complete drainage system for swampy paddy fields.

1953. Kaser, R. F. IRRIGATION AND DRAINAGE STUDIES OF TEXAS RIVERS. J. Irrig. and Drain. Div., ASAE 87(IR 3): 13-36. Sept. 1961. 290.9 Am3Ps

A report was given on a new approach to comprehensive planning for irrigation and drainage development, involving participation by local, state, and federal levels of government, now underway in Texas. Present and potential irrigation and drainage developments were summarized for the study area.

1954. Kavanagh, J. D. AN INSIGHT INTO ARTERIAL DRAINAGE. Irish Forestry. 21(2): 74-85. Autumn 1964. 99.8 Ir4

A report was given on the laws and work of the Office of Public Works in providing arterial drainage in Ireland.

1955. Keller, J., and Robinson, A. R. LABORATORY RESEARCH ON INTERCEPTOR DRAINS. J. Irrig. and Drain. Div., ASCE 85(IR 3): 25-40. 1959. 290.9 Am3Ps

The results were reported of a large scale model study concerned with the design of interceptor drains. Previously developed analytical relationships for determining the shape of the resultant water table drawdown curve were analyzed. Relationships were developed for estimating the flow from the drains. Examples were given to illustrate the use of the material.

1956. Keller, J., and Robinson, A. R. LABORATORY RESEARCH ON INTERCEPTOR DRAINS. Amer. Soc. Civil Engin. Trans. 126(3): 687-699. 1961. 290.9 Am3

The results of a large scale model study concerned with the design of interceptor drains were presented. Previously developed analytical relationships for determining the shape of the resultant water table drawdown curve were analyzed. Relationships were developed for estimating the flow from the drains. Examples were given to illustrate the use of the material.

The original article was published in the J. Irrig. and Drain. Div., ASCE 85(IR 3): 25-40. 1959.

With discussion by Messrs. M. Maasland; William F. Long; William W. Donnan; Herman Bouwer; Jan van Schilfgaarde; R. William Nelson; John G. Sutton; and A. R. Robinson.

1957. Kellogg, L. W., and Field, W. S., Jr. FARM DRAINAGE IN MICHIGAN. Land and Water Contract. 6(4): 12-13. 1964. 56.8 L222

Agricultural water management in Michigan has become a large enterprise. Michigan landowners spend more than $8,000,000 on tile drainage alone in 1963. According to the Conservation Needs Inventory of Michigan, nearly 4,000,000 acres of cropland still need treatment to remove excess water. Using a conservative estimate of $100 per acre, the cost of this treatment would be approximately $400,000,000.

Basic procedures for tile drainage in Michigan were given.

1958. Kelly, L. L. ELECTRONIC COMPUTERS IN WATERSHED RESEARCH. J. Irrig. and Drain. Div., ASCE 89(IR 3): 37-43. Sept. 1963. 290.9 3Ps

Electronic computers were used to aid in the solution of a variety of problems in soil and water conservation research. The computer has provided increased speed and accuracy in the routine processing of masses of hydrologic data.

The speed and accuracy of the computer makes it possible to conduct analytical studies that, because of the complexities of the computations and masses of numbers involved, would be virtually impossible by hand methods. Computer programs have been written and successfully used to conduct water budget studies and flood routing studies, and to test various mathematical or statistical models of water flow in channels, moisture diffusion in soils, and rainfall-runoff relationships.

1959. Kelly, L. L. ELECTRONIC COMPUTERS IN WATERSHED RESEARCH. Amer. Soc. Civil Engin. Trans. 129: 634-635. 1964. 290.9 Am3

A digest was given of an article written on the use of electronic computes in watershed research. The original article was published in the J. Irrig. and Drain. Div., ASCE 89(IR 3): 37-43, Sept. 1963.

1960. Keso, L. RECENT DRAINAGE EXPERIMENTS IN FINLAND. (Sw) Nord. Jordbrforsk. 36: 559-562. 1954. II N752

1961. Khommik, K. T. THE EFFECT OF DRAINAGE ON THE STATUS OF RIVER FLOW UNDER ESTONIA SSR CONDITIONS. (Rus) Akad. Nauk Estonskoi SSR. Izv. 4(1): 101-107. 1955. 511 Ak19

1962. Khommik, K. T. THE EFFECT OF DRAINAGE AND OTHER PHYSICAL-GEOGRAPHIC FACTORS ON THE STATUS OF RIVER RUNOFF UNDER ESTONIA SSR CONDITIONS. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOEIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, pp. 164-173. Minsk, 1956. 54.9 K83

1963. Khommik, K. T. CALCULATION OF DRAINAGE SYSTEMS. (Rus) Gidrotekh. i Melior. 10(6): 33-39. June 1958. 290.8 G362

1964. Khovanskii, G. S. NOMOGRAMS FOR HYDRAULIC COMPUTATION ON DRAINS WITH CIRCULAR AND RECTANGULAR CROSS SECTIONS. (Rus) Moscow. Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy, 37: 188-192. 1962. 292.9 M85

1965. Kiehn, F., and Liebing, U. WATER VOLUME MEASURING FOR PUMPING STATIONS. (Ge) Wasser U. Boden. 9(5): 156-159. May 1957. 56.8 W28

1966. Kienitz, G. SURFACE DRAINAGE OF THE HORTOBAGY REGION. (Hu) Vizugyi Kozlem. 1: 103-121. map. 1962. 290.9 H89
English summary, pp. 20.

A detailed plan worked out for surface drainage for the Hortobagy irrigated area in Hungary was described.

1967. Kikuoka, T. STUDY ON ROUGHNESS COEFFICIENT OF CONCRETE OPEN CHANNELS. (Ja) Mie U. Facul. Agr. B. 27: 85-126. Ref. Mar. 1963. 107.6 T78
English summary.

A study was reported on the roughness coefficient of concrete open channels (U shape) in Japan.

1968. King, L. G., and Schleusener, R. A. FURTHER EVIDENCE OF HYSTERESIS AS A FACTOR IN THE EVAPORATION FROM SOILS. J. Geophysical Res. 66: 4187-4191. 1961. 470 J823

Evaporation studies were conducted on a fine sand, which was in contact with a water table and was subjected to diurnal cyclic atmospheric conditions. Previous studies under steady atmospheric conditions showed that an inverse relation between the rate of evaporation from soils and the rate of evaporation from a free-water surface occurred under certain conditions. These studies also showed that this inverse relationship was produced by decreased evaporativity as the depth to the water table was increased. A theoretical explanation of this phenomenon was presented on the basis of a hysteresis in the functional relation between permeability and saturation of soils. The data showed that this phenomenon also occurs under cyclic atmospheric conditions.

1969. King, P. KEEP THOSE DITCHES FLOWING; GOOD CULVERTS ARE ESSENTIAL FOR EFFICIENT DRAINAGE. Pract. Power Farming. 22(6): 33. June 1959. 58.8 P872

A report was given on the need for good culverts where farm roads and tracks cross ditches and streams in England. The culverts must be well made and provide adequate support for the heavy farm equipment now used. At the same time they must not impede the flow of water particularly in wet weather.

1970. King, P. H. T. MERGING FIELDS AIDS MECHANIZATION—BUT WATCH THE DRAINAGE. Farm Mech. 11(120): 224-225. June 1959. 58.8 B772

A report was given on merging farm fields to aid in mechanization for England. When two or more fields are made into one it usually necessitates removal of some hedges and ditches. The use of closed drains to replace the ditches was stressed.

1971. Kinori, B. Z. INVESTIGATION METHODS FOR SUBSOIL DRAINAGE DESIGN: EXPERIENCE WITH FOUR CHARACTERISTIC SITES. Water Planning for Israel. P.N. 87, 13 pp. May 1960. 54 W29

A report was given on the investigation methods used in Israel for subsoil drainage design.

1972. Kinori, B. Z. INVESTIGATION METHODS FOR SUBSOIL DRAINAGE DESIGN—EXPERIENCE WITH FOUR CHARACTERISTIC SITES. Cong. Irrig. and Drain. Trans. 4(3): 11.807-11.825. maps. 1960. 55.9 C7652

A report was given on the results obtained in Israel of subsoil drainage design on four characteristic sites.

A few well-placed drains were more effective and usually less expensive than a system of dense parallel drains, despite the relatively high cost of investigations needed to determine the correct location.

1973. Kirkham, D. SEEPAGE OF ARTESIAN AND SURFACE WATER INTO DRAIN TUBES IN STRATIFIED SOIL. Trans. Amer. Geophysical Union. 35(5): 775-790. 1954. 330.9 Am3

The problem of the simultaneous upward seepage of water from an artesian basin and downward seepage of water from a ponded surface source into drain tubes was analyzed for a soil consisting of two horizontally stratified layers.

1974. Kirkham, D. THE PONDED WATER CASE. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 139-181. 1957. 4 Am392

A discussion was given of the theory of seepage of ponded water into drainage facilities. The ponded water problem has proved amenable to solution because it involves a horizonal boundary at the surface of the flow medium.

1975. Kirkham, D. SEEPAGE OF STEADY RAINFALL THROUGH SOIL INTO DRAINS. Amer. Geophysical Union Trans. 39(5): 892-908. Oct. 1958. 330.9 Am3

Theoretical formulas were given for the seepage of steady rainfall through soil into drains. There was good agreement when the theory was checked with field data.

1976. Kirkham, D. SEEPAGE INTO DITCHES FROM A PLANE WATER TABLE OVERLYING A GRAVEL SUBSTRATUM. J. Geophysical Res. 65(4): 1267-1272. Apr. 1960. 470 J823

The problem of flow of ponded water over a stratum of homogeneous soil overlying a stratum of gravel, the gravel in turn overlying an impermeable layer, was solved for the case in which equally spaced ditches penetrate into the gravel. Flow nets were obtained, as were formulas giving the quantity of water seeping through the ground into the ditches. The theory showed that unless the ditches were closer together than about three times the depth of the stratum of soil overlying the gravel, the proportion of water entering the ditches through the ditch walls was small compared with that reaching the ditches by way of the underlying gravel stratum.

1977. Kirkham, D. AN UPPER LIMIT FOR THE HEIGHT OF THE WATER TABLE IN DRAINAGE DESIGN FORMULAS. Internatl. Cong. Soil Sci. Trans. 7(1): 486-492. 1960. 56.09 In847T

A formula was derived for an upper limit of water table rise above a system of drains which remove rain water or excess irrigation water at a steady rate. The formula is the same as one derived by the author in a cited previous paper, except that the height, as earlier given, must be multiplied by a factor (1/1—R/k), where R is the rainfall rate and k is the soil hydraulic conductivity, both in the same units. The earlier formula which is an approximation is, by use of the factor, established on a firmer basis.

1978. Kirkham, D. PHYSICAL ARTIFICES AND FORMULAS FOR APPROXIMATING WATER TABLE FALL IN TILE-DRAINED LAND. Soil Sci. Soc. Amer. Proc. 28(5): 585-590. Sept./Oct. 1964. 56.9 So3

Two physical artifices were used to simplify the mathematics of the falling water table in tile-drained land. One artifice is to insert in the soil rigid frictionless, infinitesimally thin, impervious membranes along the natural soil-water seepage streamlines, or along approximate streamlines. The second artifice is to replace soil by gravel in the region above the level of the drain tube centers. The formulas were shown, theoretically, to be "on the safe side" for drainage design. The formulas agreed with experimental data.

1979. Klippert, V. I. ON THE DESIGN AND PERIODS OF SERVICE OF TILE DRAINAGE FOR DRAINING BOGS. (Rus) Belorusskaya Sel'skokhoz. Akad. Trudy, 35: 142-151. map. 1961. 106 B415

1980. Kloke, A. REPORT TO THE GOVERNMENT OF JAPAN ON THE POSSIBILITY OF IMPROVING THE MINERAL AND PEAT SOILS OF HOKKAIDO. Food and Agr. Organ. United Nations. Expanded Tech. Asst. Program. FAO Rpt. 1048, 21 pp. map. 1959. 281.9 F733E

A report was given on the improvement of mineral and peat soils in Japan. Drainage was recommended for both the peat and mineral soils. The use of peat layers on mineral soils was discussed.

1981. Klyavin'sh, Y. Y. DEGREE OF FOREST DRAINAGE IN LATVIAN SSR. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 70-76. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the classification of soils in reclaimable swamp land in Latvia to serve as a guide for the degree of forest drainage needs. The use, design, and construction of drainage systems in this area were discussed.

1982. Knobloch, H. EFFECTIVE DEVELOPMENT IN DRAINAGE TECHNIQUE. (Ge) Wasser u. Boden. 16(3): 89-90. Mar. 1964. 56.8 W28

1983. Kochev, K. M. THE UTILIZATION OF THE A. A. UGINTSCHUS METHOD FOR DETERMINING DIMENSIONS OF IRRIGATION AND DRAINAGE CANALS. (Bu) Plovdiv. Vissh Selskostopanski Inst. "Vasil Kolarov." Nauch. Trudove. 6: 507-517. 1957/58, pub. 1959. 106.3 P72
German and Russian summaries.

1984. Kodot, J. CALCULATIONS FOR REINFORCED CONCRETE CANAL TO BE CONSTRUCTED. (Por) Lav. Arroz. 13(151): 241. July 1959. 59.8 L39

1985. Kohler, M. PROBLEMS IN PLANT CULTURE OF THE BERN "SEELAND." (Ge) 90(39): 1156-1163. Sept. 28, 1962. 17 Sch9

1986. Kokot, J. CALCULATION OF A DRAINAGE CANAL FOR BANHADO GRANDE. (Por) Lav. Arroz. 9: 106): 36, 38. Oct. 1955. 59.8 L39

1987. Kokot, J. CALCULATION OF AN IRRIGATION SYSTEM. (Por) Lav. Arroz. 10: 290-291. July 1956. 59.8 L39

1988. Kokot, J. CALCULATION OF A DRAINAGE TRENCH FOR AN AREA OF 1000 HECTARES. (Por) Lav. Arroz. 14(157): 11-13. Jan. 1960. 59.8 L39

1989. Koldenhof, M. A., and Napel, G. T. EXPERIENCES IN THE ESTABLISHMENT OF WATER COURSES. (Du) Nederland. Heidemaatsch. Tijdschr. 73(12): 367-376. map. Dec. 1962. 12 N282

1990. Koning, J. C. De. APPLICATION OF FIELD DRAINAGE IN DELTAIC AREAS. Internatl. Comn. Irrig. and Drain. Annu. B. 1964: 13-20, 51. 1964. 55.9 In8A

A report was given on the design, construction, use, and maintenance of field drainage systems in deltaic areas of the Netherlands.

1991. Koning, J. C. De, and Segeren, W. A. WORK CARRIED OUT FOR RENDERING ADVICE ON THE DRAINAGE OF SOILS IN THE IJSSELMEER POLDERS. (Du) Van Zee tot Land. 36: 69-78. 1963. 54.8 V26
English summary.

A report was given on the research carried out to render advice on the drainage of soils in the IJsselmeer polder in the Netherlands.

1992. Konstantinov, V. K. EXPERIENCE IN THE USE OF AERIAL-PHOTOGRAPH MATERIALS FOR PROSPECTING AND PLANNING FOREST DRAINAGE. (Rus) Leningrad. Nauch.-Issled. Inst. Lesn. Khoz. Sborn. Rabot po Lesn. Khoz. 5: 127-137. Ref. 1962. 99.9 L545

1993. Kostiakov, A. N. ACHIEVEMENTS OF SOVIET SCIENCE IN THE FIELD OF REGULATING THE WATER REGIME OF LARGE TRACTS OF LAND. (Rus) Gidrotekh. i Melior. 11(2): 14-20. Feb. 1959. 290.8 G362

1994. Kovda, V. A. PRINCIPLES OF THE THEORY AND PRACTICE OF RECLAMATION AND UTILIZATION OF SALINE SOILS IN THE ARID ZONES. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 201-213. Ref. 1961. 278.9 Un3

A discussion was given on the principles and practice of the reclamation and utilization of saline soils in arid zones in the U.S.S.R. A classification of the saline soils in Eurasia was given along with a discussion of the secondary salinization of irrigated soils and the reclamation of solonchaks and solonchak-like soils.

1995. Kowald, F. R. CONTROLLING WATERFLOW OF UNDERGROUND WATER IN WATERLOGGED MARSHES: SOIL SCIENCE APPROACH TO PLANNING AND EXECUTION OF DRAINAGE. (Ge) Giessen, 88 pp. 1959. 54 K843

1996. Kozhanov, K. Y. DRAINAGE OF RECLAIMED MARSHES AND WATER-LOGGED MINERAL SOILS. (Rus) Gidrotekh. i Melior. 1961(6): 28-38. June. 1961. 290.8 G362

1997. Kozhanov, K. Y. NORMS OF THE DRAINAGE OF MARSHES AND IRRIGATION OF SOILS BASED ON THE DATA STUDY OF THE MOISTURE OF ROOT LAYER. (Rus) Gidrotekh. i Melior. 11: 41-45. Nov. 1964. 290.8 G362

1998. Kristiansen, K. TRIALS ON PEAT BOGS WITH FUEL PEAT CHARACTERISTICS. (No) Ny Jord 47(2): 49-67. 1960. 282.28 N98

1999. Kruse, E. G. HYDRAULICS OF SUBCRITICAL FLOW IN SMALL, ROUGH CHANNELS. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-43: 87-89. Oct. 1960. A56.9 R31

A report was given on the research in Colorado on the hydraulics of subcritical flow in small, rough channels.

2000. Kruse, G. E. THE HYDRAULICS OF SMALL, ROUGH IRRIGATION CHANNELS. Internatl. Comn. on Irrig. and Drain. 5(16): 161-176. 1963.

The resistance to flow in small soil channels, similar to irrigation furrows and borders, was studied in the laboratory. Primary factors affecting resistance were degree of turbulence, boundary roughness, and channel shape. Each channel was formed with a different roughness and was stabilized with a chemical spray to prevent erosion by the flow during a series of experimental runs.

2001. Kulen, M., and Ozgul, S. MEASURES TAKEN FOR IMPROVING THE SALINITY AND DRAINAGE CONDITIONS IN THE LOWER SEYHAN PROJECT. Near East-S. Afr. Irrig. Pract. Seminar. [Proc.] 5: 254-268. map. 1964. 173.2 In8Reg

A report was given of drainage and salinity problems in the lower Seyhan project in Turkey and measures undertaken for their improvement.

2002. Kuntze, H., and Binsack, R. CRITICAL REFLECTIONS ON THE PRESENTLY EMPLOYABLE METHODS IN CALCULATION OF SPACING OF DRAINS ON MARSH SOILS. (Ge) Praxis u. Forsch. 11(5): 133-134, 136, 138. Ref. May 25, 1959. 18 P89

2003. Kusse, A. D. THE ESTIMATION OF THE PIPE DIAMETER FOR WATER REMOVAL DRAINAGE DITCHES. (Du) Nederland. Heidemaatsch. Tijdschr. 74(7/8): 261-273. July/Aug. 1963. 12 N282

2004. Kusse, A. D. NOMOGRAM FOR DETERMINING THE DIAMETER OF DRAINAGE TILES. Netherlands J. Agr. Sci. 12(2): 113-122. May 1964. 12 N3892

With the aid of the nomogram described it is possible to determine quite simply all the factors which determine the design of a drainage system, e.g. diameters, geometric slope, the discharge intensity, drainage distance, and flow velocity in their mutual relationship.

2005. Labye, Y. NOTE ON HOOGHOUDT'S FORMULA. (Fr) Paris. Cent. de Rech. et d'Expt. de Genie Rur. B. Tech. du Genie Rur. 49(1), 18 pp. Nov. 1960. 58.9 P21

2006. Lambor, J., and Pietka, Z. APPLICATION OF HYDROELECTRIC ANALOGY TO FORCASTING OF UNSTEADY FLOW IN OPEN CHANNELS. J. Hydrol. 2(1): 44-51. Ref. 1964. 292.8 J82

Some methods of applying hydroelectrical analogy to unsteady flow in open channels were discussed.

2007. Lane, E. W. DESIGN OF STABLE CHANNELS. Amer. Soc. Civil Engin. Trans. 120: 1234-1260. 1955. 290.9 Am3

The method of designing stable channels which is presented was based on securing a distribution of the tractive force along the sides and bottom of the channels such that the magnitude of this force at all points will be sufficiently large to prevent sediment deposits in objectionable quantities, and at the same time will be small enough to prevent objectionable scour. Limiting values for the tractive force were offered for the various conditions under which a canal may be contructed. The effect of bends, side slope, and transported material on the design was reviewed. Also presented was a method of designing canals having a minimum of excavation and a minimum width in coarse, noncohesive material.

2008. Larson, C. L., and Allred, E. R. PLANNING PUMP DRAINAGE OUTLETS. Agr. Engin. 37: 38-40. Jan. 1956. 58.8 Ag83

The use of small, individually owned pumping plants as outlets make it possible to drain areas that lack a gravity outlet or they can be used to replace a long tile main or a deep outlet ditch.

Steps for the design of drainage pumping plants were given for both regular service and emergency use.

2009. Larson, C. L., and Machmeier, R. E. AGRICULTURAL ENGINEERS REPORT ON PARALLEL TERRACES FOR MINNESOTA. Minn. Farm and Home Sci. 20(1): 3-4. Fall 1962. 100 M668

A report was given on the design, construction, and use of parallel terraces in Minnesota.

2010. Larson, C. L., and Manbeck, D. M. IMPROVED PROCEDURES IN GRASSED WATERWAY DESIGN. Agr. Engin. 41(10): 694-696. Oct. 1960. 58.8 Ag83

Simplified design procedures were given for waterway designs.

2011. Larson, C. L., and Manbeck, D. M. FACTORS IN DRAINAGE PUMPING EFFICIENCY. Agr. Engin. 42(6): 296-297, 305. June 1961. 58.8 Ag83

A report was given on plant design of drainage pumping systems that save construction cost without increasing operation cost.

2012. Larson, C. L., and Manbeck, D. M. TILE FLOW AND POWER USE DATA FOR PUMP DRAINAGE SYSTEMS. Trans. ASAE 5(2): 207-209. 1962. 290.9 Am32T

Tile flow and power use data were given for designing pump drainage systems.

2013. Larson, W. E., and Schaller, F. W. SPACING OF LEVEL TERRACES IN WESTERN IOWA. Agr. Engin. 39(1): 20-23. Jan. 1958. 58.8 Ag83

In a study of spacings of level terraces in western Iowa, it was concluded that the terraces can be spaced wider than currently recommended provided that corn is lister planted.

2014. Laurenson, E. M. A CATCHMENT STORAGE MODEL FOR RUNOFF ROUTING. Water Res. Found. Austral. Rpt. 11, 18 pp. map. Sept. 1964. 292.9 W296R

A procedure was given to reproduce the surface runoff hydrograph of a catchment from the rainfall-excess, knowing the lag of the catchment and its variation with discharge. Application of the procedure to an experimental catchment was described.

2015. Laursen, E. M. SEDIMENT-TRANSPORT MECHANICS IN STABLE-CHANNEL DESIGN. Amer. Soc. Civil Engin. Trans. 123: 195-203. 1958. 290.9 Am3

The three requisites for a stable alluvial channel were explicitly stated, and the role of sediment transport in each was assessed. The paper demonstrates the similarity of the many sediment-transport formulas, and the general method of their application to design was illustrated. The use of these formulas as sealing relationships between different channels was advocated.

2016. Leach, H. D. TILE DRAINAGE HELPS POORLY-DRAINED SOILS. Rhodesia Agr. J. 56(4): 148-152. July/Aug. 1959. 24 R34

A report was given on the needs and design of tile drainage systems for poorly drained soils in Rhodesia.

2017. Lee, F. S. Y. CRITICAL FLOW IN TERMS OF HYDRAULIC EQUIVALENTS. J. Irrig. and Drain., ASAE 88(IR 2): 1-19. June 1962. 290.9 Am3Ps

The principle of hydraulic equivalent was presented for the study of the critical flow in open channels. Based on the modification of the equation of specific energy and the introduction of equivalent coefficients, graphs were prepared.

2018. Lee, F. S. Y. CRITICAL FLOW IN TERMS OF HYDRAULIC EQUIVALENTS. Amer. Soc. Civil Engin. Trans. 128(3): 470-488. 1963. 290.9 Am3

The principle of hydraulic equivalent was presented for the study of the critical flow in open channels. Based on the modification of the equation of specific energy and the introduction of equivalent coefficients, graphs were prepared. These graphs, developed originally in the metric system and used for many years, will assist engineers in the analysis of open channels.

With discussion by Messrs. N. Rajaratnam; S. Davis; Ralph W. Powell; and Francis S. Y. Lee. pp. 488-496.

2019. Lees, P. M. DRAINAGE. In Walmsley, R. C., ed. RURAL ESTATE MANAGEMENT. Ed. 13. Estates Gaz., London. pp. 481-504. 1955. 282.171 W16

A report on drainage in England was given in this chapter of the book. The drainage of buildings and lands were discussed.

2020. Lehmann, T. TECHNIQUE OF DRAINAGE ON STONY SOILS. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(1): 29-34. Jan. 1964. 18 W763

2021. Lembke, W. D. HYDRAULICS OF PIPE OUTLETS FOR TILE DRAINS. Agr. Engin. 41(6): 375-377. June 1960. 58.8 Ag83

A basis was given for the selection of the correct size of outlet pipe for a tile drainage system.

2022. Lembke, W. D., Delleur, J. W., and Monke, E. J. MODEL STUDY OF FLOW IN STEEP TILE DRAINS. Trans. ASAE 6(2): 142-144. 1963. 290.9 Am32T

Gravity flow on steep slopes was studied in 60-foot model drains in the laboratory. Five different flow regimes were reported during the transition from part full flow in each of the model drains.

2023. Lencastre, A. DESIGN OF GRAVITY DRAINAGE SYSTEMS WITH THE OUTLET SUBJECTED TO THE INFLUENCE OF TIDES. (Method applied in the design of the drainage system of the great "Leziria" of Vila Franca de Xira). Cong. Irrig. and Drain. Trans. 4(6): C.81-C.92. 1960. 55.9 C7652

A report was given on the design of a gravity drainage system in France with the outlet subjected to the influence of tides.

2024. Leningrad Severnyi Nauchno-Issledovatel'skii Institut Gidrotekhniki I Melioratsii. DRAINAGE OF OVERWET LANDS IN THE U.S.S.R. Cong. Irrig. and Drain. Trans. 4(2): 11.115-11.128. 1960. 55.9 C7652

A report was given on the drainage research and development of drainage areas in the U.S.S.R.

2025. Leushev, A. N. ON THE PROBLEM OF THE WATER DISCHARGE OF MINERAL SOILS. (Rus) Belorusskaya Sel'skokhoz. Akad. Trudy. 35: 114-123. 1961. 106 B415

2026. Leutheusser, H. J. TURBULENT FLOW IN RECTANGULAR DUCTS. Amer. Soc. Civil Engin. Trans. 129: 659-661. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a study on the turbulent flow in rectangular ducts. The original article was published in the J. Hydraul. Div. ASAE 89(HY 3): 1-19. May 1963. References to the discussion and closure were listed.

2027. Levanovskii, L. B. STABLE FORMS OF TRANSVERSE SECTIONS OF CANAL BEDS. (Rus) In Akademiia Nauk Sovet po Izucheniia Proizvoditel'nykh Sil. ISSLEDOVANIIA DEFORMAISII KANALOV I V VLIIANIIA OROSHENIIA NA GRUNTOVYE VODY V NIZOV'IAKH AMU-DAR'I. Moskva, Akademiia Nauk SSSR, 1956. pp. 61-69. Ref. 1956. 55 Ak131

2028. Li, S. C. APPLICATIONS OF AQUIFER PERFORMANCE CURVES. (Ch) Taiwan Water Conserv. (ser. 11) 4(44): 17-23, 83. Dec. 1963. 292.8 T13
English summary.

A report was given on a time-drawdown curve and a distance-drawdown curve developed from pumping test data in China that can be used as performance curves for an aquifer from which water is being pumped. This permits accurate selection of pumping equipment and helps to determine proper well spacing.

2029. Li, W.-H. OPEN CHANNELS WITH NONUNIFORM DISCHARGE. Amer. Soc. Civil Engin. Trans. 120: 255-274. 1955. 290.9 Am3

Steady flows in an open channel with the addition of water along the course of flow are encountered frequently in engineering practice. An equation based on the principle of conservation of momentum was derived in this paper. For cases in which the loss of energy bacause of friction is of secondary importance, solutions were obtained for prismatic channels of various cross sections and slopes. The hydraulic behavior of the flow was described with nondimensional quantities, and the validity of the theory was verified by tests on model channels.
With discussion by Turgut Sarpkaya, and Wen-Hsiung Li. pp. 275-280.

2030. Ligon, J. T., Johnson, H. P., and Kirkham, D. UNSTEADY-STATE DRAINAGE OF FLUID FROM A VERTICAL COLUMN OF POROUS MATERIAL. J. Geophysical Res. 67(13): 5199-5204. Ref. Dec. 1962. 470 J823

The unsteady-state drainage of fluid from a vertical column of porous material was studied theoretically and experimentally. Equations were derived to predict the location of the surface of saturation and the rate of discharge as functions of time. Experimental data were obtained for glycerol draining from a glass bead column. There was good agreement between theory and experiment when the assumptions underlying the theoretical development were met.

2031. Ligon, J. T., Johnson, H. P., and Kirkham, D. GLASS BEAD-GLYCEROL MODEL FOR STUDYING FALLING WATER TABLE BETWEEN OPEN DITCH DRAINS. Trans. ASAE 6(1): 61-64. Ref. 1963. 290.9 Am32T

A model was reported of a ditch drainage system designed and constructed, using glass beads and glycerol for studying the falling water table between open ditch drains.

2032. Ligon, J. T., Kirkham, D., and Johnson, H. P. THE FALLING WATER TABLE BETWEEN OPEN DITCH DRAINS. Soil Sci. 97(2): 113-118. Feb. 1964. 56.8 So3

Equations were derived to predict the location of the following water table, with time, between parallel, equally apaced ditched drains which are partially filled with open water.

2033. Linford, A. FLOW MEASUREMENT & METERS. Ed. 2. E. & F. Spon Ltd., 430 pp. 1961. 290 L64

A second edition was given on the art of metering the flow of fluids through open and closed conducts.

2034. Linthorst, T. J., and Steegeman, A. G. J. MOVEMENT OF EARTH IN COMPLEX I OF THE LAND IMPROVEMENT PROJECT "ET LAND VAN HEUDSEN EN ALTENS." (Du) Wageningen. Inst. v. Cult. tech. en Waterhuishouding. Meded. 38, 8 pp. 1962. 282.9 W12
English summary.

A report was given on the movement of earth needed for drainage for a large drainage project in the Netherlands. The amount of peat that can be used as fill material was discussed.

2035. Lipatov, K. G. DETERMINATION OF AVERAGE DISCHARGE FOR MANY YEARS OF SMALL WATER-INTAKE STREAMS, FOR THE DRAINAGE OF LANDS. (Rus) Moscow Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy. 37: 147-157. 1962. 292.9 M85

2036. List, E. J. THE STEADY FLOW OF PRECIPITATION TO AN INFINITE SERIES OF TILE DRAINS ABOVE AN IMPERVIOUS LAYER. J. Geophysical Res. 69(16): 3371-3381. 1964. 470 J823

A solution was given to the problem of the steady flow of precipitation to an infinite series of tile drains above an impervious layer. The free surface boundary conditions were exactly satisfied, but the shape of the impervious layer was approximated. Capillary forces were neglected. The theoretical results were compared with limited field measurements, and good agreement was found. The solutions become less accurate when the drains were very close to the impervious layer. The limiting cases were shown.

2037. Liu, H. K., and Hwang, S. Y. DISCHARGE FORMULA FOR STRAIGHT ALLUVIAL CHANNELS. J. Hydraul. Div., ASCE 85(HY 11): 65-98. Nov. 1959. 290.9 Am3Ps

The proposed discharge formula contains a discharge coefficient and exponents for hydraulic radius and slope. Both the coefficient and the velocities were given as functions of bed forms and bed material. Velocities computed by the formula checked closely with those obtained in the laboratory.

2038. Liu, H.-K., and Hwang, S.-Y. DISCHARGE FORMULA FOR STRAIGHT ALLUVIAL CHANNELS. Amer. Soc. Civil Engin. Trans. 126(1): 1787-1822. Ref. 1961. 290.9 Am3

The proposed discharge formula contains a discharge coefficient and exponents for hydraulic radius and slope. Both the coefficient and the exponents are given as functions of bed forms and bed material. Velocities computed by the formula check closely with those obtained in the laboratory.

With discussion by Messrs. T. Blench; G. H. Lean; Lucien M. Brush, Jr.; Don M. Culbertson and Paul R. Jordan; Bruce R. Colby; C. Blanchet; D. R. Dawdy and R. W. Carter; M. Gamal Mostafa; James K. Culbertson, And Carl F. Nordin, Jr.; R. J. Garde; John L. Bogardi; and Shoi-Yean Hwang. pp. 1822-1857.

2039. Lloyd, R. D., and Myers, V. I. FLUCTUATING HIGH WATER TABLES. Nev. Ranch and Home Res. Rev. 2(2): 4-5. 1961. 100 N41N

A report was given fluctuating high water tables in Nevada.

2040. Lowndes, A. G. DRAINAGE OF SUGAR CANE LANDS IN N.S.W. Colonial Sugar Refining Co. Unnumbered Rpt., 16 pp. 1962. 65 C721D

An illustrated report was given on the need and installation of drainage for sugarcane lands in New South Wales in Australia.

2041. Lubiako, E. I. METHODS OF PLANNING THE DRAINAGE SYSTEMS IN BELORUSSIA SSR. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, Minsk, pp. 40-48. 1956. 54.9 K83

2042. Lubiako, G. N. BASIC EQUATIONS OF THE MOVEMENT OF GROUND WATERS TOWARD DRAINS IN HETEROGENEOUS SOILS. (Rus) In Akademiia Nauk Sovet po Izucheniiu Proizvoditel'nykh Sil. ISSLEDOVANIIA DEFORMATSII KANALOV I VLIIANIIA OROSHENIIA NA GRUNTOVYE VODY V NIZOV"IAKH AMU-DAR'I. Moskva, Akademiia Nauk SSSR, pp. 197-221. 1956. 55 Ak131

2043. Ludwig, H. F., Gram, A. L., and Feeney, J. L. POLLUTION—URBAN VS RURAL IN IMPERIAL VALLEY WATERS. II. Water and Sewage Works. 108(8): 308-314. map. Ref. Aug. 1961. 290.8 M92

A discussion was given of the problem of irrigation and drainage waters polluting streams and the Sulton Sea in California.

2044. Lujic, R. CONTRIBUTION TO THE KNOWLEDGE OF BENCHES FOR SOIL EROSION CONTROL. (Se) Sumarstvo. 10(11/12): 701-712. 1957. 99.8 Su63
English and French summaries.

A report was given on the design and use of level bench terraces in Yugoslovia for soil erosion control and saving of soil moisture.

2045. Lundgren, H., and Jonsson, I. G. SHEAR AND VELOCITY DISTRIBUTION IN SHALLOW CHANNELS. J. Hydraul. Div., ASCE 90(HY 1): 1-21. Jan. 1964. 290.9 Am3Ps

The distribution of the bottom shear stresses in an open channel was found by various approximate methods. For a shallow channel, a fair approximation was obtained when the shear was assumed to correspond to the vertical depth. When the incline of the bottom was appreciable, however, it was better to calculate the shear by measuring the depth at right angles to the bottom. A more consistent method was to let the shear correspond to the area between two bottom normals. However, these methods did not consider the transfer to shear (in the direction of flow) through the "depth lines." The proposed new method overcame this difficulty by assuming that there was no transfer of shear through the orthogonals to the lines of equal mean velocity. The other basic assumption was that the velocity distribution was logarithmic along the bottom normals, corresponding to the local friction velocity. For a plane bottom with a transverse slope of 30°, the shear stresses were 40 percent higher than found by conventional methods. The method could not be used on polygonal cross sections.

2046. Lushchikhin, N. N. PECULIARITIES OF GROUND WATER REGIME IN ARGILLACEOUS DEPOSITS ON THE TERRITORY OF SHELTERBELTS AND CONDITIONS OF INFLOW OF GROUND WATERS TO ADJACENT FIELDS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timirazeva. Dok. TSKHA. 1957(29): 365-367. 20 M857

2047. Luthin, J. N. THE FALLING WATER TABLE IN TILE DRAINAGE. II. PROPOSED CRITERIA FOR SPACING TILE DRAINS. Trans. ASAE 2(1): 44-45. 1959. 290.9 Am32T

A report was given on proposed criteria for spacing of drain tile in a study of the falling water table in tile drainage.

2048. Luthin, J. N. THE DRAINAGE OF SLOPING LAND. Internatl. Cong. Agr. Engin. 6(II): 169-175. 1964. 290.9 C765C

The problem of drainage of sloping land was analyzed and compared with a solution obtained with the Hele-Shaw viscous flow model. The results obtained by the two different methods were comparable.

2049. Luthin, J. N., and Day, P. R. LATERAL FLOW ABOVE A SLOPING WATER TABLE. Soil Sci. Soc. Amer. Proc. 19: 406-410. Oct. 1955. 56.9 So3

The lateral movement of water above a water table was studied under steady-state conditions. The dependence of the capillary conductivity on soil moisture tension was considered in making a theoretical analysis of the problem.

The methods described were applicable to other steady-state flow problems including drainage of land.

2050. Luthin, J. N., and Hall, H. SOIL DRAINAGE NEAR GUADALUPE. Calif. Agr. 11(1): 7-8. Jan. 1957. 100 C12Cag

A report was given on the use of observation wells to study drainage conditions as part of an investigation of factors affecting plant growth. Water table conditions were studied in the Guadalupe areas of California.

2051. Luthin, J. N., and Reeve, R. C. DRAINAGE OF IRRIGATED LANDS. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7:344-371. 1957. 4 Am392

The engineering aspects were discussed for the drainage of irrigated lands.

2052. Luthin, J. N., and Scott, V. H. SOIL DRAINAGE INVESTIGATIONS. Calif. Agr. 10(5): 8, 14. May 1956. 100 C12Cag

A report was given on the investigations needed to design and install a successful drainage systems in Calfornia. Soil conditions and source of water to be drained must be known. The use was described for jetting piezometers and well points to obtain this information .

2053. Luthin, J. N., and Worstell, R. V. THE FALLING WATER TABLE IN TILE DRAINAGE-A LABORATORY STUDY. Soil Sci. Soc. Amer. Proc. 21(6): 580-584. Ref. Nov./Dec. 1957. 56.9 So3

A sand-filled tank was used to study the distribution of hydraulic head and quanity of tile outflow during drainage in a laboratory study. The measurements of the transient phase of drainage known as the falling water table were compared with the theoretical developments of Kirkham and Gaskell as well as Childs. The shapes of the experimental water tables were similar to the theoretical shapes, but the rate of fall was not accurately predicted by the theory.

2054. Luthin, J. N., and Worstell, R. V. THE FALLING WATER TABLE IN TILE DRAINAGE. III. FACTORS AFFECTING THE RATE OF FALL. Trans. ASAE 2(1): 45-47, 51. Ref. 1959. 290.9 Am32T

A report was given on the factors affecting the rate of fall in a study of the falling water table in tile drains.

2055. Maasland, M. SOIL ANISOTROPY AND LAND DRAINAGE. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 216-285. 1957. 4 Am392

A discussion was given of the theory of the effects of anisotropic soils on land drainage.

2056. Maasland, M. WATER TABLE FLUCTUATIONS INDUCED BY INTERMITTENT RECHARGE. J. Geophysical Res. 64(5): 549-559. Ref. May 1959. 470 J823

The problem of water table fluctuations in response to repeated recharges was considered. The effect on the water table of intermittent constant recharge (recharge applied intermittently at a constant rate) and of intermittent instantaneous recharge (recharge applied instantaneously at regular intervals) was analyzed in detail. The final results were shown to consist of a combination of periodic and transient components; the transients are monotonic decreasing functions.

The theory may be applied to problems of ground water flow through aquifers and to land drainage problems.

2057. Maasland, M. WATER TABLE FLUCTIONS INDUCED BY IRRIGATION. J. Irrig. and Drain. Div., ASAE 87(IR 2): 39-58. June 1961. 290.9 Am3Ps

The theory of intermittent recharge was extended and analyzed. Equations were presented from which charts may be prepared for easy computation of drain spacings for irrigated agriculture. The analytical results may also be used to compute the effect of natural drainage on the height of the water table as well as anticipated changes of the water table of newly irrigated areas.

2058. Maasland, M. WATER TABLE FLUCTUATIONS INDUCED BY IRRIGATION. Amer. Soc. Civil Engin. Trans. 128(3): 142-161. 1963. 290.9 Am3

The theory of intermittent recharge, as previously developed, was extended and analyzed. Equations were presented from which charts may be prepared for easy computation of drain spacings for irrigated agriculture. The analytical results may also be used to compute the effect of natural drainage on the height of the water table as well as anticipated changes in the water table of newly irrigated areas.

2059. Macau-Vilar, F. DRYING AND WATERING OF "LA NAVA DE CAMPOS"—5,000 HECTARES. (Fr) Cong. Irrig. and Drain. Trans. 4(2): 11.305-11.332. maps. 1960. 55.9 C7652 English summary.

The design of the irrigation and drainage system needed for an area in Spain was discussed.

2060. McCool, D. K., and Beasley, R. P. TERRACE CHANNEL DESIGN USING THE SPATIALLY VARIED FLOW AND TRACTIVE FORCE THEORIES. Mo. Agr. Expt. Sta. Res. B. 778, 32 pp. Ref. July 1961. 100 M693

A report was given on terrace channel alignment in Missouri by use of the spatially varied flow and tractive force theories.

2061. McCool, D. K., Beasley, R. P., and Berry, I. L. TERRACE CHANNEL DESIGN USING SPATIALLY VARIED FLOW AND TRACTIVE FORCE THEORIES. Trans. ASAE 5(2): 190-191, 196. 1962. 290.9 Am32T

A report was given on terrace channel design by the use of spatially varied flow and tractive force theories.

2062. McMartin, A. THE ELEPHANT MARSH, NYASALAND; ITS POTENTIAL FOR DEVELOPMENT. So. African Sugar J. 45(6): 498-499, 501, 503, 505. June 1961. 65.8 So8

A report was given on the potential for development of the Elephant Marsh in Nyasaland, South Africa. The soil survey shows the need of extensive land leveling and drainage.

2063. McNeary, S. S., Remson, I., and Chen, H. S. C. HYDRAULICS OF WELLS IN UNCONFINED AQUIFERS. J. Hydraul. Div., ASCE 88(HY 6): 115-123. Nov. 1962. 290.9 Am3Ps

The differential equation describing unsteady radial flow to a well in an unconfined aquifer has no simple solution in terms of elementary functions because transmissibility decreases as the aquifer is dewatered. A numerical solution was achieved for an assumed relationship between transmissibility and head of water. Curves were presented showing the head of water in a homogeneous aquifer as a function of radial distance from the well and time elapsed after the water level in the well is lowered to and maintained at a given level. The curves are suitable for predicting water levels near such a well and for determining the hydraulic characteristics of unconfined aquifers from properly devised aquifer tests.

2064. Maierhofer, C. R. SOME ELEMENTS OF DRAINAGE OF IRRIGATED LANDS. Irrig. Engin. and Maintenance. 6(1): 14-15, 32-34. Jan. 1956. 55.8 Ir722

A report was given on the subsurface drainage necessary to control ground water which in turn controls salinity on irrigated lands in subhumid areas. Irrigated subsurface drains are from 8 to 15 foot deep while in humid areas, subsurface drains are rarely deeper than 5 feet, and usually 4 feet or less.

The value of open drains, closed drains, pumped wells for deep drainage, and recharge wells was discussed. Closed drain designs were given for the subhumid areas.

2065. Maierhofer, C. R. DRAINAGE AND RELATED PROBLEMS OF THE HELMAND VALLEY DEVELOPMENT PROJECT, AFGHANISTAN; REPORT. [Washington] 54 pp. illus. 1961. 156.85 D782

A report was given on drainage and related problems of the Helmand Valley Development project in Afghanistan.

2066. Malecki, W. ON TERM AND PROPER CONSERVATION OF LAND IMPROVEMENT DEVICES AS GUARANTEE OF HIGH YIELDS. (Pol) Wiad. Melior. i Lakarskie. 5(4): 113-114. July/Aug. 1962. 54.8 W63

2067. Mamisao, J. P. AN INVESTIGATION OF LIGUASAN MARSH IN COTABATO PROVINCE, PHILLIPPINES TO DETERMINE THE FEASIBILITY OF RECLAIMING IT. Philippine Agr. Engin. J. 5: 81-88. 1955. 58.8 Ag88

A report was given on the investigation of Liguasan Marshes in the Phillipines to determine the feasibility of reclaiming the area.

Large drainage projects in other countries were discussed and a program was suggested for draining the marshes in the area studied.

2068. Manson, P. W., and Blaisdell, F. W. ENERGY LOSSES AT DRAINTILE JUNCTIONS. Agr. Engin. 37: 249-252, 257. Apr. 1956. 58.8 Ag83

Laboratory results indicated no significant advantage from a practical standpoint between a 45° and a 90° junction angle in agricultural tile drainage systems.

2069. Manson, P. W., and Blaisdell, F. W. NEW IDEAS ON DRAIN TILE JUNCTIONS. Minn. Farm and Home Sci. 16(1): 18. Oct. 1958. 100 M668

Research results were discussed on the degree of angle needed for drain tile junctions in Minnesota. The 90-degree entry angle made by a lateral entering a main gave as good results as the commonly recommended 45-degree junction.

2070. Manson, P. W., and Miller, D. G. SUGGESTED SHORT-TIME PERMEABILITY TESTS FOR CONCRETE DRAIN TILE. Amer. Concrete Pipe Assoc. Tech. Memo., 11 pp. Aug. 1, 1957. 299.9 Am33

A 5-minute absorption test was discussed for concrete drain tile that gave results that correlated comparably with actual leakage in the field.

2071. Mao, S.-W., and Rice, L. SEDIMENT-TRANSPORT CAPABILITY IN ERODIBLE CHANNELS. J. Hydraul. Div., ASCE 89(HY 4): 69-95. July 1963. 290.9 Am3Ps

A procedure that was developed to provide a means of evaluating the need for sediment control for the link canals being constructed in West Pakistan as part of the Indus Basin Project was presented. The procedure utilizes basic concepts of the Einstein bed-load function to evaluate the sediment-transport capability of an erodible channel having variable sediment concentrations and size distributions entering the head reach.

Data for existing canals in West Pakistan were used to illustrate the application of the procedure.

2072. Mao, S.-W., and Rice, L. SEDIMENT-TRANSPORT CAPABILITY IN ERODIBLE CHANNELS. Amer. Soc. Civil Engin. Trans. 129: 792-793. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a study of sediment-transport capability of erodible channels. The original paper was published in the J. Hydraul. Div., ASCE 89(HY 4): 69-95, July 1963. The references to the discussions and closure were listed.

2073. Markov, E. S. CLIMATIC CONDITIONS AND THEIR IMPORTANCE FOR THE RECLAMATION AND UTILIZATION OF SWAMPED-OVER BOTTOMLANDS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 56: 63-73. 1960. 20 M857

2074. Markov, E. S. TYPES OF SWAMPED BOTTOMLANDS AND THEIR RECLAMATION METHODS. (Rus) Pochvovedenie. 1960(8): 14-23. Aug. 1960. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 8: 810-816. Aug. 1960. 57.8 P34Ae

A report was given on the drainage and irrigation requirements necessary to reclaim and farm waterlogged flood plains in the U.S.S.R.

2075. Martinez, E. R. LOCATION, CAPACITY AND COST OF DRAINAGE. (Sp) B. Azucarero Mex. 118: 26-28. Apr. 1959. 65.8 B63

2076. Martinez, E. R. LOCATION, CAPACITY, AND COST OF DRAINAGE. (Sp) Mex. Agr. 6(67): 59-61. Sept. 1959. 8 M5762

2077. Maslov, B. S. WATER-BALANCE CALCULATIONS IN DRAINAGE SCHEME DESIGNING. (Rus) Gidrotekh. i Melior. 1960(4): 20-24. Apr. 1960. 290.8 G362

2078. Matsubara, S. EFFECTS ON THE GROUND WATER OF THE LAND SINKING. (Ja) Nogyodoboku-Kenkyu. 27(1): 12-16. May 1959. 290.8 N68
English summary.

Statistical methods were given on determining infiltration of sea water on agricultural lands that cause land sinking in Japan.

2079. Matsubara, S. EFFECTS ON THE GROUND WATER OF THE LAND SINKING. (Ja) Nogyodoboku-Kenkyu. 27(2): 72-77. July 1959. 290.8 N68
English summary.

A report was given on the effect of free ground water that infiltrates from the source at finite distance from the seashore and the confined ground water on land sinking in Japan.

2080. Matsushita, F. THE BOUNDARY LAYER DEVELOPMENT IN OPEN CHANNELS WITH A SMOOTH BED. III. EXPERIMENTAL RESULTS. (Ja) Nogyodoboku-Kenkyu. 27(6): 393-396. Feb. 1960. 290.8 N68
English summary.

Theoretical results of the development of a turbulent boundary layer in open channels with a smooth bed were compared with experimental results in Japan.

2081. Matsushita, F. A STUDY ON THE BOUNDARY LAYER DEVELOPMENT IN OPEN CHANNELS AND ITS APPLICATIONS. (Ja) Mi U. Facul. Agr. B. 27: 127-197. Ref. Mar. 1963. 107.6 T78
English summary.

A Japanese study of the boundary layer development in open channels with a smooth bed was reported.

2082. Mayer, P. G. ROLL WAVES AND SLUG FLOWS IN INCLINED OPEN CHANNELS. Amer. Soc. Civil Engin. Trans. 126(1): 505-535. 1961. 290.9 Am3

Roll waves and slug flows were established as two distinctly different wave patterns and were phenomenologically studied in an inclined open channel. The basic characteristics of flow were expressed in terms of pertinent physical properties. A theory was presented and reference was made to similar phenomena in allied fields in which mathematical analyses exist.

With discussion by Messrs. F. F. Escoffier; R. Hugh Taylor and John F. Kennedy; Tojiro Ishihara, Yuichi Iwagaki, and Yoshiaki Iwasa; and Paul G. Mayer. pp. 535-564.

2083. Mayo, K. L. GUIDE LINE MOLE DRAINAGE OF ROLLING CLAY DOWNS. New Zeal. J. Agr. 94(5): 501, 503, 505, 507-509. May 15, 1957. 23 N48J

Guide lines for the use of mole drains on rolling clay downs in New Zealand were given and illustrated.

2084. Meerson, G. M. RECLAMATION AND UTILIZATION OF FLOOD LANDS IN THE NONCHERNOZEM AREA. (Rus) Zemledelie. 6(1): 55-58. Jan. 1958. 20 Z44

2085. Mendes, F. D. S. THE IMPORTANCE OF AEROPHOTOGRAMMETRY IN THE PLANNING OF DRAINAGE AND DAM PROJECTS. (Por) Lav. Arroz. 17(193): 9-10, 32. Mar./Apr. 1963. 59.8 L39

2086. Merbitz, H. IMPROPER DRAINAGE REDUCES PROFITS. (Ge) Mitt. der Deut. Landwirt.-Gesell. 79(11): 344, 346-348. Mar. 12, 1964. 18 N39

2087. Mersereau, H. E. HOW TO BUILD A LILY-BED. No. Amer. Lily Soc. Lily Ybk. 13: 84-85. 1960. 96.46 N81

A report was given on the building of a raised lily-bed to provide proper drainage and other growing conditions.

2088. Meyer, J. L., and Houston, C. E. AREA-WIDE DRAINAGE; HERRINGBONE PATTERN AND INTERCEPTION TYPE SYSTEMS SOLVE DRAINAGE PROBLEMS. Calif. Agr. 13(7): 11. July 1959. 100 C12Cag

A report was given on the installation and use of the herringbone pattern and interception type drainage systems used in California to solve drainage problems.

2089. Middleton, R. V. D. CONTOUR TERRACING FOR TEA ESTATES. Tea. 1(3): 49, 51-52. Apr. 1960. 68.19 T224

A report was given on the planning and use of contour terracing for tea estates in East Africa.

2090. Milchev, M. P. CALCULATION OF PLOUGHED TERRACES. (Bu) Sofia. Tsent. Nauchnoizsled. Inst. po Pochvoznanie i Agrotekh. "Nikola Pushkarov." Izv. 2: 149-157. 1962. 56.9 So2
English summary.

A report was given on the design of plowed terraces in Bulgaria. Formulas were presented for terrace design work.

2091. Milchev, M., and Dimitrova, E. DEVICE FOR COMPUTATION OF PLOWED AND OTHER STEP-LIKE TERRACES, BASED ON THE SOIL DEPTH. (Bu) Akad. Selskostopanskite Nauk. Bulg. Inst. Pochvozanie Agrothekh. Izv. 6: 185-192. 1963. 56.9 So2
English summary.

A device was described and illustrated that is based on soil depth and in use for the computation of plowed and step-like terraces in Bulgaria.

2092. Mirajgaoker, A. G., and Charlu, K. L. N. NATURAL ROUGHNESS EFFECTS IN RIGID OPEN CHANNELS. J. Hydraulics Div. ASCE 89(HY 5): 29-44. Sept. 1963. 290.9 Am3Ps

The effects of large natural roughness in open channel flow were studied. There was an attempt to create conditions of boulder streams by fixing natural stones, from 2-1/2 inches to 3 inches in diameter, to the bed of a 3-feet wide rigid bed flume. Six different patterns of boulder placements were tried, and the roughness densities varied from 15 stones per square yard to 114 stones per square yard.

2093. Missouri Agricultural Experiment Station. A NEW METHOD OF TERRACING. Mo. Agr. Expt. Sta. B. 699, 15 pp. Apr. 1958. 100 M693

A new method of terrace layout and construction was given that reduces the curvatures of terraces and the point rows between them. The design, layout, and construction of these parallel terraces were given for Missouri conditions.

2094. Monke, E. J. A STUDY OF WATER FLOW PATTERNS NEAR SUBSURFACE DRAINS. Diss. Abs. 20(1): 230. July 1959. 241.8 M58

A study was reported on water flow patterns near subsurface drains in Illinois.

2095. Moore, W. L., and Morgan, C. W. HYDRAULIC JUMP AT AN ABRUPT DROP. Amer. Soc. Civil Engin. Trans. 124: 507-516. 1959. 290.9 Am3

The hydraulic jump may form at various locations relative to a low abrupt drop in a rectangular channel. The role of the drop in determining the form of the jump and in stabilizing its position is clarified by analysis and experiment. The application of the results to the analysis of a stilling basin was presented.

With discussion by Messrs. Murray B. McPherson; John W. Forster; and Walter L. Moore and Carl W. Morgan. pp. 512-524.

2096. Morant, R. De. PREPARATION OF IRRIGATION DITCHES OF PROVENCE AND THE PROVENCALE REGION. (Fr) Potasse. 35(281): 15-20. map. Jan. 1961. 57.8 P84

2097. Mordeno, A. G. DRAINAGE OF LOGGING ROADS. Forestry Leaves. 15(1): 1-18. Ref. 1964. 99.8 P532

A report was given on the need, design, construction, and use of drainage of logging roads in the Philippines.

2098. Morel-Seytoux, H. J. DOMAIN VARIATIONS IN CHANNEL SEEPAGE SLOW. J. Hydraul. Div., ASCE 90(HY 2): 55-79. Mar. 1964. 290.9 Am3Ps

A general method was presented to calculate the seepage discharge from a channel of a complex shape. The method was based on use of Hadamard's formula for the variation of the Green's function when the shape of the region for which the Green's function was known had changed. The method was used to calculate the seepage from channels of a complex shape that may be considered almost trapezoidal (or triangular). A simple geometrical construction yields the trapezoidal (or triangular) equivalent channel from which the same quantity of water was lost. Graphs of seepage discharge in dimensionless form were given for trapezoidal and triangular channels.

2099. Morozov, A. T. THEORETICAL CALCULATION OF LEACHING PECULIARITIES OF SALTY SOILS ON ALLUVIAL CONE OF THE SHIRVAN STEPPE. (Rus) In Pochvennyi Institut imeni V. V. Dokuchaeva. MELIORATSIYA POCHV KURA-ARAKSINSKOI NIZMENNOSTI. pp. 185-243. Ref. 1962. 54 P753Me

2100. Morris, H. M. FLOW IN ROUGH CONDUITS. Amer. Soc. Civil Engin. Trans. 120: 373-398. 1955. 290.9 Am3

A new concept of flow over rough pipe and channel surfaces was presented. The concept was based particularly on the effect of the longitudinal spacing of surface-roughness elements and their associated vorticity streams. Three basic flow types were denoted as isolated-roughness flow, wake-interference flow, and quasi-smooth (or skimming) flow.

The friction-factor equations derived for these three types of flow appeared to be substantiated by data obtained by many experimenters on all types of roughnesses in both pipes and open channels. The equations can be extended to surfaces of variable roughness so that reasonably accurate predictions of the friction factor can be made for all types of conduit surfaces. The concept is physically reasonable and relatively simple; it bears promise of becoming a useful and rational method for the hydraulic design of conduits.

With discussion by Messrs. Victor L. Streeter, Walter Rand, Harry H. Ambrose, and Henry M. Morris. pp. 399-410.

2101. Morris, H. M. DESIGN METHODS FOR FLOW IN ROUGH CONDUITS. J. Hydraul. Div., ASCE 85(HY 7): 43-62. July 1959. 290.9 Am3Ps

Design curves and methods were presented for determining friction factors for turbulent flow in closed conduits and tranquil open channel flow. The methods were physically realistic, being based on five distinct regimes of turbulence and related to the actual physical dimensions of the boundary roughness elements.

2102. Morris, H. M. DESIGN METHODS FOR FLOW IN ROUGH CONDUITS. Amer. Soc. Civil Engin. Trans. 126(1): 454-473. 1961. 290.9 Am3

Design curves and methods are presented for determining friction factors for turbulent flow in closed conduits and tranquil open channel flow. The methods are physically realistic, being based on five distinct regimes of turbulence and related to the actual physical dimensions of the boundary roughness elements.

With discussion by Messrs. F. V. A. Engel; P. Ackers; Nicholas Bilonok; John A. Roberson; and Henry M. Morris. pp. 474-490.

2103. Motoc, M. D. PROBLEMS CONCERNING TERRACE PLANNING FOR VINEYARDS. (Rum) Gradina, Via si Livada. 9(6): 16-21. June 1960. 80 G75
English summary.

Four types of problems were discussed for planning terraces for vineyards in Rumania.

2104. Multamaki, S. E. EFFECT OF FOREST DRAINAGE ON RUNOFF CONDITIONS OF PEAT SOILS. (Ge) Finland Metsantutkimuslaitos. Julkaisuja. 55(23), 15 pp. map. Ref. 1962. 99.9 F493

2105. Murray, J. A. RECENT ADVANCES IN THE HYDRAULICS OF GROUND-WATER FLOW TO GRAVITY WELLS UNDER STEADY AND NON-STEADY FLOW CONDITIONS. Irrig. and Power. 18(10): 891-907. Ref. Oct. 1961. 55.9 In222C

A report was given on recent advances in the hydraulics of ground water flow to gravity irrigation and drainage wells under steady and non-steady flow conditions.

A satisfactory analytical solution was obtained to the problem of steady flow pattern near a gravity well in a uniform water-bearing medium by skillful use of relaxation methods.

2106. Myagi, K. A. FIELD METHODS OF DETERMINATION OF FILTRATION COEFFICIENT FOR CONSTRUCTION OF DRAINAGE SYSTEM. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 125-133. 1962. 20 M857

2107. Myers, L. E. Jr. RELATIONSHIP OF IRRIGATION TO PUBLIC HEALTH. Amer. Soc. Civil Engin. Trans. 123: 846-850. 1958. 290.9 Am3

In planning and operating irrigation projects, the engineer should be aware of the health problems that arise. Serious mosquito-caused public problems exist in many irrigated areas of the United States. These problems are primarily the result of the same faulty irrigation structures and practices that cause water waste, damaged soils, and reduced crop production.

2108. Myers, V. I. PROCEDURES FOR EVALUATING DRAINAGE PROJECT FEASIBILITY. Cong. Irrig. and Drain. Trans. 4(2): 11.17-11.32. Ref. 1960. 55.9 C7652

Procedures were given for evaluating drainage project feasibility.

2109. Myers, V. I., Ussery, L. R., and Rippert, W. J. PHOTOGRAMMETRY FOR DETAILED DETECTION OF DRAINAGE AND SALINITY PROBLEMS. Trans. ASAE 6(4): 332-334. 1963. 290.9 Am32T

The application was described of aerial photograph interpretation to detect the severity and extent of salt affected areas, associated with fluctuating water tables on two non-irrigated cotton fields in Texas.

2110. Myhre, D. L. WATER TABLE FLUCTUATIONS IN SANDY SOILS AT HASTINGS, FLORIDA. Soil and Crop Sci. Soc. Fla. Proc. 18: 179-183. 1958. 56.9 So32

A report was given on the measurement of water table fluctuation in sandy soils in Florida for the design of drainage and irrigation systems.

2111. Mylvaganam, T. THE DRAINAGE OF MADAMPE LAKE, CEYLON. Cong. Irrig. and Drain. Trans. 3(4): 9.159-9.170. map. 1957. 55.9 C7652

A report was given on a proposed plan for drainage and irrigation structure for Madampe Lake in Ceylon to: (1) Reduce the flooding in the catchment of the lake; (2) prevent the intrusion of salt water in the lake basin; and (3) store water in the lake sufficient to irrigate 3,500 acres.

2112. Napel, C. T., Veldman, E. C., and Willet, J. R. MECHANICAL CALCULATION OF DRAINAGE DISTANCE. (Du) Nederland. Heidemaatsch. Tijdschr. 74(10): 368-381. Oct. 1963. 12 N282

2113. Nathan, K. DEPTH AND SPACING OF PARALLEL DRAIN TILE LATERALS. J. Soil and Water Conserv. 16(2): 81-82. Mar./Apr. 1961. 56.8 J822

A report was given on a comparison of theoretical drain tile spacing with field results in New Jersey. Fair agreement was found between the Visser and Donnan-Slater methods and the actual installations in 8 out of 10 cases.

2114. Nazarov, M. I. SPEED PROFILE AND ROUGHNESS COEFFICIENT OF PAVED CANALS. (Rus) Akad. Nauk Kirgizskoi SSR. Inst. Vodnogo Khoz. i Energetiki. Trudy. 1956(3): 79-95. Ref. 1956. 292.9 Ak1

2115. Nazaruk, G. EXECUTION OF IMPROVEMENT WORKS IN KUWASY PEAT BOG AREA. (Pol) Warsaw. Inst. Melior. i Uzytkow Zielonych. Wiad. 3(3): 25-56. map. 1963. 54.9 W262W

2116. Neill, C. R. HYDRAULIC ROUGHNESS OF CORRUGATED PIPES. J. Hydraul. Div., ASCE 88(HY 3): 23-44. May 1962. 290.9 Am3Ps

Original data was given on friction losses in two types of corrugated-metal pipes. A comprehensive friction factor-Reynold's number diagram, incorporating all published data on corrugated-metal pipes, was presented and used to develop a relationship between peak friction factors and relative depth of corrugations. A flow formula was developed to replace the Manning formula, but a table of n values, for use with the Manning formula, was also given.

Corrugated-metal pipes produced a different type of friction factor-Reynold's number diagram from other types of commercial pipe. The data available on standard pipe with 1/2 inch deep corrugations indicate that peak values of f were proportional to the square root of relative corrugation depth, and that consequently, values of Manning's n decreased as pipe diameter increased. For structural plate pipe with 2-inch deep corrugations, the data were those reported for a 60-inch size only.

2117. Nelson, R. W. DESIGN OF INTERCEPTOR DRAINS IN HETEROGENEOUS SOILS. J. Irrig. and Drain. Div., ASAE 87(IR 4): 41-53. Dec. 1961. 290.9 Am3Ps

An approximate method was given for including variable permeability in a design procedure for interceptor drains. The analysis requires a water table contour map for transposing the flow system in heterogeneous soil, to an equivalent system, having constant permeability throughout. Reverse-transformation of the prediction from the uniform soil system to the field problems gives the expected condition after drainage facilities are installed.

2118. Nemec, J. HYDROLOGICAL DATA FOR RECLAMATION OF WATERLOGGED LAND BY DRAINAGE PROJECTS. Cong. Irrig. and Drain. Trans. 4(2): 11.281-11.292. 1960. 55.9 C7652

A report was given on the need of hydrological data for waterlogged lands in drainage projects in Czechoslovakia.

2119. Nevano, G. RECLAMATION OF WATERLOGGED SOIL AND LAND NOT CULTIVATED ON ACCOUNT OF EXCESSIVE WATER CONTENT. (Fr) Cong. Irrig. and Drain. Trans. 4(3): 11.827-11.838. 1960. 55.9 C7652

2120. Neves, J. B., and Abecasis, F. M. DRAINAGE, IRRIGATION, FLOOD CONTROL AND NAVIGATION PROBLEMS IN THE GEBA RIVER (PORTUGUESE GUINEA). Internatl. Comn. Irrig. and Drain. 4(5): 14.371-14.388. 1960. 55.9 C7652

Drainage, irrigation, flood control, and navigation problems in the Geba river were discussed.

The suggested solutions for the drainage problem includes the construction of side hill canals with gravity outlets into the river and a low system of canals from which the water would be conveyed to the pumping stations.

2121. Nielsen, D. R. PERCOLATION OF WATER IN SOIL. In PROCEEDINGS SEEPAGE SYMPOSIUM PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 47-56. Jan. 1965. A56.9 R31

A discussion was given on percolation of water into soil as it effects the design of drainage systems for seepage control.

2122. Nolte, B. H., and Beasley, R. P. AN INVESTIGATION OF FARM DRAINTILE TERRACE OUTLETS. Trans. ASAE 7(1): 94-96. 1964. 290.9 Am32T

A study was reported on the use of farm drain tile as terrace outlets in Missouri.

2123. Nolte, B. H., and Beasley, R. P. THE EFFECT OF FLOW VELOCITY AND TILE JOINT SPACING AND MISALIGNMENT ON THE HEAD EXERTED AGAINST SOIL SURROUNDING FARM DRAIN TILE. Mo. Agr. Expt. Sta. Res. B. 852, 14 pp. Feb. 1964. 100 M693

A report was given on the effect of flow velocity and tile joint spacing and misalignment on the head exerted against soil surrounding farm drain tile in Missouri.

2124. Norum, E. M. FACTORS AFFECTING FURROW GRADE. Hawaii Sugar Technol. Proc. 18: 47-49. 1959. 65.9 H317

A discussion was given on the factors affecting furrow grade for landleveling.

2125. Offengenden, S. R. CHANGING THE EFFICIENCY FACTOR OF IRRIGATION CANALS WHEN PREVENTING SEEPAGE. (Rus) Gidrotekhnika i Melioratsiya. 1961(4): 10-13. Apr. 1961. 290.8 G362

2126. Ogata, H. AN ELECTRICAL ANALOGUE METHOD FOR REPRESENTING A SEEPAGE SURFACE OF GROUND WATER INTO DITCH. (Ja) Nogyodoboku-Kenkyu. 27(6): 397-402. Feb. 1960. 290.8 N68 English summary.

A report was given on an electrical analogue method used in Japan for representing a seepage surface of ground water into ditches.

2127. Ogawa, T. CONTROL OF WATER TABLE IN DRAINED LANDS—PREVENTION OF OVERDRAINAGE. Cong. Irrig. and Drain. Trans. 5(5): G.17.1-G.17.26. 1963. 55.9 C7652

A review was given of the papers presented on the control of water table in drained lands—prevention of overdrainage at the fifth congress on irrigation and drainage at Tokyo, Japan.

2128. Ohmstede, W. D. NUMERICAL SOLUTION OF TRANSIENT FLOW OF WATER IN UNSATURATED SOIL WITH APPLICATIONS TO OUTFLOW FROM SOIL MOISTURE EXTRACTORS. J. Geophysical Res. 69(4): Ref. Feb. 15, 1964. 470 J823

The results were reported of a program of numerical analysis of nonlinear partial differential equations which described nonsteady soil moisture transfer. The results, when combined with experimental data, were intended for use in determining the soil moisture transfer characteristics of various types of soil. The results indicated that linear theory is significantly inaccurate in representing unsaturated transient flow of water in soils for finite perturbations. On the other hand, for step-function transient outflow experiments performed for determination of soil moisture transfer characteristics, the numerical solutions presented here allowed all data obtained from the experiments to be used in characterizing the soil water diffusivity over the full range of the step.

2129. Olbertz, M. H. TECHNICAL METHODS OF PLASTIC PIPE DRAINAGE. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(2): 79-82. Feb. 1964. 18 W763

2130. Olerinskii, V., and Volkova, N. DESIGNING RECLAMATION MEASURES IN FOREST MANAGEMENT. (Rus) Lesn. Khoz. 10: 71-72. Oct. 1962. 99.8 L5622

2131. Ollos, G. AN INVESTIGATION INTO THE EFFECT OF PADDY FIELDS OF GROUND-WATER CONDITIONS. Internatl. Comn. Irrig. and Drain. Annu. B. 1959: 22-29. 1959. 55.9 In8A

The basic hydraulic problems of the relationship between ground water table and infiltration from paddy fields was discussed of the basis of scale model tests. The hydraulic aspects of paddy field design in Hungary were summarized.

2132. Omelin, N. N. ON PARAMETERS OF WATER-LIFTING EQUIPMENT FOR VERTICAL DRAINAGE. (Rus) Gidrotekh. i Melior. 2: 13-18. Feb. 1964. 290.8 G362

2133. Oosterkamp, J. L. DRAINAGE AND IRRIGATION IN NETHERLANDS. Allahabad Farmer. 38(1): 8-24. Ref. Jan. 1964. 22 AL5

A report was given on drainage and irrigation in the Netherlands.

2134. Ordoveza, J. L. A DETERMINATION OF THE RETARDANCE COEFFICIENTS OF OPEN CHANNELS IN VOLUSIA SOIL OF NEW YORK STATE. Diss. Abs. 17(1): 113-114. Jan. 1957. 241.8 M58

A report was given on the determination of the retardance coefficients of open drainage channels for diversion ditches in Volusia soil in New York.

2135. Ordoveza, J. L., and Dano, P. L. EFFECT OF UNDERDRAINAGE ON THE YIELD OF CORN AND THE RATE OF DROP OF THE WATER TABLE. Philippine Agr. 42(2/3): 86-92. July/Aug. 1958. 25 P542

The design of a closed system for drainage of corn was given. Bamboo tubes, bamboo blind pyramid drains, clay tiles, and concrete tiles were used. There was no significant differences for the different kinds of tile as it affected corn yield.

2136. Ostromecki, J. DESIGNING THE LONGITUDINAL PROFILE OF DITCHES AND DRAINAGE FOR PEAT LANDS, WITH CONSIDERATION GIVEN TO SUBSIDENCE. (Pol) Roxz. Nauk Roln. Ser. F. Melior. i Uzytkow Zielonych. 71-F-3: 739-778. 1956. 20.5 R59
English summary.

Methods were given for the proper design of level ditch bottom and drainage of peat lands to reduce subsidence in peat lands in Poland. Simplified formulas were given in the form of norms and tables.

2137. Ostromecki, J. METHOD AND NOMOGRAMS FOR EVALUATING THE SUBSIDENCE OF PEAT SOILS UNDER THE INFLUENCE OF DRAINAGE. Cong. Irrig. and Drain. Trans. 4(6): C.105-C.111. 1960. 55.9 C7652

A method and nomograms were given for evaluating the subsidence of peat soils under the influence of drainage in Poland.

2138. Ota, K. PROBLEMS OF IMPROVEMENT OF WATER SUPPLY TO PADDY FIELD AND DEVELOPMENT OF AGRICULTURAL PRODUCTIVITY; FROM INVESTIGATION ON EARLY CULTURE OF RICE PLANT IN THE IBI RIVER BASIN. (Ja) Gifu U. Facul. Agr. Res. B. 11: 227-234. map. Dec. 1959. 107.6 G364
English summary.

A report was given the improvements of drainage and irrigation systems needed in Japan to supply water for rice culture.

2139. Ouwerkerk, J. H. Van. THE DRAINAGE FORMULA OF DON KIRKHAM. (Du) Nederland. Heidemaatsch. Tijdschr. 74(3): 119-126. Mar. 1963. 12 N282

2140. Owen, W. H. THREE NEW SYSTEMS OF CONSTRUCTING TERRACES. (Sp) Agr. de las Amer. 8(6): 17-18, 62. June 1959. 58.8 Ag832

2141. Padoan, G., Batini, C., and Molinari, C. RECLAMATION OF WATERLOGGED AND UNCULTIVABLE LAND OWING TO THEIR EXCESSIVE WATER CONTENT. (Fr) Cong. Irrig. and Drain. Trans. 4(2): 11.193-11.240. maps. Ref. 1960. 55.9 C7652
English summary.

A discussion was given on the land reclamation program in Italy. Theoretical and practical approaches concering the draining of waterlogged areas were given along with short descriptions of various land reclamation projects in Italy.

2142. Palikko, E. DRAINAGE TRIALS ON EXPERIMENTAL FARM OF AGRICULTURAL RESEARCH CENTER AT TIKKURILA. (Fi) Finland Maatalouden Koetoiminnan Keskusvaliokunta Maatalous ja Koetoiminta. 12: 37-41. 1958. 64.9 F49
English summary.

A report was given on drainage research at the Agricultural Research Center in Finland during 1951-53. Research on the distance between closed drains (16 m. and 32 m.) and depth of drains (60 cm., 90 cm., and 120 cm.) was reported. Mole drains, brush drains, and gravel drains were tested.

2143. Parvet, A. WHY THE SOIL MAY REMAIN TOO WET EVEN AFTER THE RECONSTRUCTION OF DRAINAGE SYSTEMS. (Es) Sotsialist. Pollum. 17(20): 922-923. Oct. 1962. 20 So74

2144. Pedrero, J. J. PRELIMINARY INVESTIGATION FOR THE CONSTRUCTION OF AN AGRICULTURAL DRAINAGE SYSTEM. (Sp) Ingen. Hidraul. en Mex. 15(2): 47-64. maps. Apr./June 1961. 290.8 In43
English summary.

A report was given of the preliminary investigations needed for an agricultural drainage system in Mexico for wet lands and irrigated lands with and without alkali problems.

2145. Pedrero, J. J. AGRICULTURAL DRAINAGE; DEPTH AND SPAN REQUIRED BETWEEN DRAINS. (Sp) Ingen. Hidraul. en Mex. 15(4): 29-36. maps. Oct./Dec. 1961. 290.8 In43
English summary.

A report was given on a study of the depth and distance between open drains and tile drains on irrigated lands in Mexico.

2146. Pekatoros, L. G. SOIL-MELIORATIVE CHARACTERISTIC OF THE INGUL RIVER FLOODPLAIN IN THE BLACK SEA LOWLAND. (Rus) Pochvovedenie. 9: 85-94. Ref. Aug. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 9: 880-887. Ref. Aug. 1963. 57.8 P34Ae

A report was given on the design and need of drainage for salinity control for some bottom-land soils in the Black Sea Lowland of the U.S.S.R.

2147. Penskoi, I. K. IN REGARD TO DETERMINING THE DISTANCE OF EFFECTIVE ACTION OF DRAINS. (Rus) Vsesoiuzn. Akad. Sel'skokhoz. Nauk im. V. I. Lenina. Dok. 21(7): 36-40. Ref. 1956. 20 Ak1

2148. Perekhrest, S. M. REASONS OF OVERWETTING OF MINERAL SOILS FED BY RAINFALL AND SOME CONSIDERATIONS ON DESIGN RATES OF DRAINAGE. (Rus) Gidrotekh. i Melior. 1961(2): 28-36. Feb. 1961. 290.8 G362

2149. Peterson, D. F., and Mohanty, P. K. FLUME STUDIES OF FLOW IN STEEP, ROUGH CHANNELS. J. Hydraul. Div., ASCE 86(HY 9): 55-76. 1960. 290.9 Am3Ps

Based on observations of both natural streams and flume experiments, three classifications of flow in steep, rough, open channels were proposed: Tranquil; tumbling; and rapid. The tranquil and rapid regimes are dominated by subcritical and supercritical flow, respectively. In the tumbling regime the roughness elements induce supercritical flow over their crests followed by individual hydraulic jumps to the tranquil state. The characteristics of flow in each of the proposed regimes were described, and criteria for delineating the regimes were proposed.

2150. Peterson, D. F., Jr. THE THEORY OF DRAINAGE BY PUMPING FROM WELLS. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 181-215. 1957. 4 Am392

A discussion was given on the theory of drainage by pumping from wells. Pumped wells offer the possibility, in many instances, of overcoming the restrictions of location and potential imposed by natural outlets.

2151. Peterson, D. F., Jr. INTERCEPTING DRAINAGE WELLS IN ARTESIAN AQUIFER. Amer. Soc. Civil Engin. Trans. 127(3): 32-39. 1962. 290.9 Am3

A formula for channel seepage to a leaky artesian aquifer and for the resulting piezometric surface was presented. A potential function accounting for excess irrigation and leaching water applied to agricultural lands was proposed. Using this function in combination with conventional well potential theory, a method for designing intercepting drainage wells for such an aquifer underlying irrigated lands was described.

With discussion by Messrs. Mahdi S. Hantush; and Dean F. Peterson, Jr. pp. 34-42.

2152. Petrescu, N., Eftimie, A., Chirila, A., and Neagu, G. CALCULATION HYPOTHESES ON THE HORIZONTAL BODY IN PASSING UNDER THE DIKE. (Rum) Jassy. Inst. Agron. "Ion Ionescu de la Brad." Lucrari Sti. 1962: 475-484. 1962. 106.4 J31L
French summary.

2153. Phelan, J. T. BENCH LEVELING FOR SURFACE IRRIGATION AND EROSION CONTROL. Trans. ASAE 3(1): 14-17. 1960. 290.9 Am32T

The use of bench leveling for surface irrigation and erosion control was discussed. A method was shown to provide near minimum earthwork quanities consistent with water supply, farming, and the drainage requirements.

2154. Philip, A. W. EFFICIENT TILE DRAINAGE. Farm Mech. 12(134): 349-351. Oct. 1960. 58.8 B772

Advice was given on the planning and installation of tile systems in Scotland.

2155. Pickard, W. F. SOLVING THE EQUATIONS OF UNIFORM FLOW. J. Hydraul. Div., ASCE 89(HY 4): 23-38. July 1963. 290.9 Am3Ps

The differential equation governing the flow of liquid in an open channel was shown to lead naturally to 12 different types of stream-depth profiles. When this equation was transformed to a form suitable for integrating, the 12 profiles led to 4 different integrals of two terms each. It was shown that any of the integrals was simply expressible in terms of one of three higher transcendental functions, the backwater integrals of the first, second, or third kinds. The latter functions were considered in detail for the parameter ranges of interest in hydraulics. Functions of the second kind were integrated in closed form. Functions of the first and third kinds were expressed in terms of a finite series of polylogarithms and polynomials of moderate order.

Practical evaluation methods were presented, and emphasis was placed on techniques suited for use with high speed digital computers.

2156. Pickard, W. F. SOLVING THE EQUATIONS OF UNIFORM FLOW. Amer. Soc. Civil Engin. Trans. 129: 769-770. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a research study on the equation of uniform flow in open channels. The original article was published in the J. Hydraul. Div., ASCE 89(HY 4): 23-28, July 1963. The references to the discussion and closures were listed.

2157. Pillsbury, A. F. CONCRETE PIPE AND DRAINAGE. Irrig. Engin. and Maintenance. 6(5): 16-17, 34-36. May 1956. 55.8 Ir722

The design of drainage systems of concrete pipe was given for the drainage of irrigated lands. The drainage of irrigated land by pumping, ditches, and tile drains (clay and concrete) was explained.

2158. Pillsbury, A. F., Pelishek, R. E., and Buras, N. WETTING EXPANSION OF DRAINTILE AND ITS EFFECTS ON WATER ENTRY. Trans. ASAE 3(1): 88-89. 1960. 290.9 Am32T

Results were reported of tests on wetting expansion of clay tile and cement tile and its effects on water entry.

2159. Pillsbury, A. F., Weeks, L. O., Spencer, J. R., and Reeve, R. C. DISCHARGE OF TILE DRAINAGE SYSTEMS IN AN IRRIGATED AREA OF CALIFORNIA. Amer. Geophysical Union Trans. 37: 474-476. Aug. 1956. 330.9 Am3

Measurements of discharge from the drains in the irrigated area of Coachella Valley of California were plotted. A simple equation was developed to give maximum discharge in terms of drainage area or length of tile.

2160. Pisar'kov, K. A. PRACTICAL SIGNIFICANCE OF SOME HYDROLOGICAL FACTORS FOR THE DETERMINATION OF THE DEGREE OF DRAINAGE OF FOREST LAND. (Rus) In Minsk Belorusskii Tekhnologicheskii Institut. POVYSHENIE PRODUKTIVNOSTI LESOV ZAPADNȲKH I TSENTRAL'NYKH RAIONOV SSSR. pp. 88-95. 1962. 99.45 M662

2161. Pogosov, P. S. DETERMINATION OF THE GYPSUM STANDARDS IN THE IMPROVEMENT OF SOLONETZ SOILS. (Rus) Akad. Nauk Armianskoi SSR. Izv. Biol. i Sel'skokhoz. Nauk, 8(12): 3-13. Dec. 1955. 20 Er4

2162. Posey, C. J., and Pagay, S. N. MANNING'S FORMULA FOR WIDE TRAPEZOIDAL CHANNELS. Amer. Soc. Civil Engin. Trans. 129: 151-152. 1964. 290.9 Am3

A digest was given of a report on the use of Manning's formula for wide trapezoidal channels. The original article was published in Civil Engin. 33(3): 71, March 1963.

2163. Post, C. J. Van Der, and Schie, J. J. Van. DRAINAGE OF GREENHOUSE SOILS. (Du) Naaldwijk. Proefsta. v. de Groenten- en Fruitteelt onder Glas. Jaarverslag. 1960: 47-49. 1960. 86 N112J
English summary, pp. 154-155.

A report was given on the need and use of tile drainage for greenhouses in the Netherlands. For deep drainage, the use of tile drainage plus pump drainage from a sump was recommended.

2164. Powell, R. W., and Posey, C. J. RESISTANCE EXPERIMENTS IN A TRIANGULAR CHANNEL. J. Hydraul. Div., ASCE 85(HY 5): 31-63. May 1959. 290.9 Am3Ps

A 400-foot adjustable-slope triangular flume was tested smooth and roughened with small rectangular battens at various spacings. A comparison was made of Manning's formula with some more recent suggestions, and the velocity distribution, secondary currents, and other phenomena were reported.

2165. P'yavchenko, N. I., and Sabo, E. D. FUNDAMENTALS OF FOREST DRAINAGE. (Rus) Moskva, Goslesbumizdat., 380 pp. maps. Ref. 1962. 99.74 P57

2166. Rabochev, I. S. ON PRINCIPLES OF REGULATING SALT MOVEMENT IN THE SOIL. (Rus) Gidrotekh. i Melior. 8: 17-21. Aug. 1963. 290.8 G362

2167. Rachinskii, V. V., and Tszya, D. L. STUDY OF THE DYNAMICS OF THE LEACHING OF A SALT SOLUTION FROM THE SOIL BY MEANS OF RADIOACTIVE INDICATORS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 70: 127-132. 1961. 20 M857

2168. Ramser, E. APPROPRIATE SOLUTION OF PROBLEMATIC QUESTIONS IN THE DRAINAGE OF COHESIVE SOILS. (Ge) In SCHWEIZERISCHE BAUZERTUNG 100 JAHRE EIDG. TECHNISCHE HOCHSCHULE. pp. 619-622. n.p., 1955. 276.4 Z8S

2169. Rao, N. S. G., and Dhar, D. M. A NEW DISCHARGE FORMULA FOR WASTE-WEIRS (BYEWASHES). Irrig. and Power. 18(10): 908-917. Oct. 1961. 55.9 In222C

A simple discharge formula was given for waste weirs (byewashes) which are normally used as flood escapes in small tanks in India. This formula can also be used for computing the discharge of a chute spillway.

2170. Rapp, E. ENGINEERING ASPECTS OF LAND LEVELING. Canada Dept. Agr. P. 1145, 27 pp. map. May 1963. 7 C16Pu

A report was given on the engineering for land leveling in Canada.

2171. Rasis, M. De. NEW TYPE OF TEMPORARY DITCH FOR THE CONSERVATION OF SOIL AND REGULATION OF SURFACE AND INFILTRATION WATERS FOR PROTECTION OF THE ROCCA IMPERIALE-CANNA IN CALABRIA. (It) Genio Rur. 26(11): 1095-1097. Nov. 1963. 281.8 R522

2172. Rauste, E. HYDROLOGY ACTIVITIES OF THE ENGINEER DIVISION OF AGRICULTURAL ADMINISTRATION IN FINLAND. (Ge) Wasser u. Boden. 13(2): 33-36. Feb. 1961. 56.8 W28

2173. Rawlins, S. L., and Gardner, W. H. A TEST OF THE VALIDITY OF THE DIFFUSION EQUATION FOR UNSATURATED FLOW OF SOIL WATER. Soil Sci. Soc. Amer. Proc. 27: 507-511. 1963. 56.9 So3

A review of the derivation of the diffusion equation from the potential equation for unsaturated flow of liquids in porous materials revealed that the only additional assumption required was that diffusivity is a unique function of water content. The validity of this assumption was tested by following absorption of water into a horizontal column of soil with a gamma ray densitometer. To ensure that required boundary conditions were met, the soil was evacuated to eliminate entrapped air or air pressure buildup ahead of the wetting-front; and water was applied quickly, evenly, and at constant negative head through a plane sintered glass bead plate, pressed against the bare plane end of the column to initiate flow. Diffusivity vs. water content curves constructed from these data revealed that diffusivity was not a function of water content alone.

2174. Razumov, G. A. DEEP HORIZONTAL RADIAL DRAINAGE. (Rus) Gidrotekh. i Melior. 3: 31-38. Mar. 1963. 290.8 G362

2175. Ree, W. O. RETARDATION COEFFICIENTS FOR ROW CROPS IN DIVERSION TERRACES. Trans. ASAE 1(1): 78-80. 1958. 290.9 Am32T

Flow retardance coefficients were reported for several row-planted crops planted in diversion terraces. The Manning's values were found to be related to the product of velocity and hydraulic radius when the velocities were great enough to displace the vegetation.

2176. Rege, N. D., Tamhane, V., and Uppal, H. L. STANDARDS FOR RECLAMATION OF SALINE AND ALKALI SOILS. I. and II. Near East-S. Afr. Irrig. Pract. Seminar. [Proc.] 5: 285-304. map. 1964. 173.2 In8Reg

Standards were given for the reclamation of saline and alkali soils in India.

2177. Rego, Z. J. P. D. C. D. THE APPLICATION OF THE THEORY OF CHARACTERISTICS TO THE STUDY OF THE VARIABLE SYSTEM IN CANALS. (Por) Lisbon. Inst. Super. de Agron. An. 23: 105-301. Ref. 1959/60. 105.7 L682

2178. Reid, R. O., and Wilson, B. W. BOUNDARY FLOW ALONG A CIRCULAR CYLINDER. Amer. Soc. Civil Engin. Trans. 129: 334. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a research study on the boundary flow along a circular cylinder. The original article was published in the J. Hydraul. Div., ASCE 89(HY 3): 21-40, May 1963. References to the discussion and closure were listed.

2179. Reisenauer, A. E. METHODS FOR SOLVING PROBLEMS OF MULTIDIMENSIONAL, PARTIALLY SATURATED STEADY FLOW IN SOILS. J. Geophysical Res. 68(20): 5725-5733. Oct. 15, 1963. 470 J823

A computer program for solving steady-state Darcian transport of fluid in heterogeneous, partially saturated, porous mediums was described. The program is capable of handling one-, two-, and three-dimensional and axisymmetrical problems with up to 8000 grid points. Instability of the equations and its control were discussed. Solutions of typical problems that are important in industrial waste disposal, irrigation, and drainage were presented.

2180. Remson, I., Drake, R. L., McNeary, S. S., and Wallo, M. VERTICAL DRAINAGE OF AN UNSATURATED SOIL. J. Hydraul. Div., ASCE 91(HY 1, proc. paper 4196): 55-74. Jan. 1965. 290.9 Am3Ps

The general equation describing vertical unsaturated flow of soil water was solved by numerical approximation for several cases. The computer programs were described.

2181. Reshetkina, N. M., and Rachinskii, A. A. PROBLEMS AND PRINCIPLES OF THE RECLAMATION OF VIRGIN LANDS. (Rus) Gidrotekh. I Melior. 8: 3-9. 1964. 290.8 G362

2182. Richard, F. WATER BALANCE AND DRAINAGE OF PASTURE SOILS. Schweiz. Anst. f. das Forstl. Versw. Mitt. 39(5): 247-269. Ref. 1963. 99.9 Sch92
English summary.

A report was given on a plan to work out drainage-solutions for pasture soils in Switzerland as a function of: (1) Hydraulic conductivity; (2) depth of the impermeable layer; (3) interface of layers with different hydraulic conductivity; (4) slope; and (5) drain spacing.

2183. Richart, F. E. REVIEW OF THE THEORIES FOR SAND DRAINS. Amer. Soc. Civil Engin. Trans. 124: 709-736. 1959. 290.9 Am3

The existing theories for vertical consolidation of clays by vertical flow of water and by radial flow to a drain well were satisfactory within the limits of the assumptions. The effect of considering void ratio as a variable did not significantly change the consolidation-time characteristics of vertical consolidation by vertical flow. Thus, including the effects of variable void ratio does not contribute toward the explanation of secondary consolidation.

It was demonstrated that a drain well having a smeared zone at its periphery can be considered as an equivalent "ideal" well of reduced diameter. Diagrams were included for quantitative evaluation of this relation. An example was included to show the effectiveness of even a small diameter ideal well in reducing the time for consolidation.

With discussion by Messrs. Yoshichika Nishida; S. J. Johnson; and F. E. Richart. pp. 737-739.

2184. Rijtema, P. E. CALCULATION OF CAPILLARY CONDUCTIVITY FROM PRESSURE OUTFLOW DATA WITH NON-NEGLIGIBLE MEMBRANE IMPEDANCE. Inst. for Land and Water Mangt. Res., Wageningen. Tech. B. 12, 209-215. 1959. 282.9 W12T

The flow equation describing the movement of water out of a soil sample placed in a pressure plate apparatus was solved for the case that the impedance of the membrane or porous plate was accounted for.

2185. Rodier, J. SOME DATA ON FLOW IN THE EQUATORIAL FORESTS. (Fr) In Internatl. Assoc. of Sci. Hydrol. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge, 1: 155-163. 1959. 292.9 As7C

2186. Ronkin, E. I. FROM THE EXPERIENCE OF BUILDING A LAND EMBANKMENT WITH THE DRAIN PRISM AT THE BASE OF A DOWN-STREAM SLOPE. (Rus) Gidrotekh. i Melior. 7(10): 21-28. Oct. 1955. 290.8 G362

2187. Rosser, J. FLOW OF WATER IN A CHANNEL LINED WITH KIKUYU GRASS [PENNISETUM CLANDESTINUM]. Queensland J. Agr. Sci. 21(1): 59-70. Mar. 1964. 23 Q37

A report was given of flow of water in a grazed and ungrazed grassed waterway of Kikuyu-grass in Australia.

2188. Rossum, H. Van. MEASUREMENT OF SUPPLY AND REMOVAL DITCHES. II. (Du) Nederland. Heidemaatsch. Tijdschr. 66: 277-282. Nov. 1955. 12 N282

2189. Rossum, H. Van. THE FUNCTION AND MANAGEMENT OF DITCHES. (Du) Landbk. Tijdschr. 70(7/8): 599-610. July/Aug. 1958. 105.2 Or3

2190. Rossum, H. Van. DISCHARGE AND TEMPORARY STORAGE OF EXCESS WATER IN CULTIVATED LANDS. Cong. Irrig. and Drain. Trans. 4(2): 11.293-11.304. 1960. 55.9 C7652

A discussion was given of the need of canals to drain the excess water from cultivated land and ponds or lakes to store the water for future use in the Netherlands. The use of asphalt linings for the canals was discussed.

2191. Russell, W. J. SURFACE SATURATION OF GRASSLAND ON THE WEALD AND LONDON CLAY. Brit. Grassland Soc. J. 13(1): 21-22. Mar. 1958. 60.19 B773

The use of mole drains between two tile drains was recommended for the reduction of surface soil saturation on clay grassland soils in England.

2192. Ruud, O. TANKS IN OPEN DITCHES AT THE ENTRANCE TO COVERED DITCHES. (No) Norsk Landbr. 17: 555. Aug. 17, 1962. 11 N8122

2193. Sabo, E. D. INTENSITY OF DRAINAGE OF WATERBOGGED FORESTS. (Rus) In Akademiya Nauk SSSR. Laboratoriya Lesovedeniya. NOVYE LESOVODSTVENNYE ISSLEDOVANIYA. pp. 57-61. Moskva, 1960. 99.34 Ak12

2194. Sakai, T. FINAL REPORT ON THE RECLAMATION OF STEEP LANDS. Food and Agr. Organ. United Nations Expanded Tech. Asst. Program FAO Rpt. 1678, 8 pp. 1963. 281.9 F733E

A report was given on the reclamation of land in Israel by terraces, irrigation, and subsurface drainage.

2195. Sakurai, J. ECONOMIC ANALYSIS OF IRRIGATION AND DRAINAGE PLANS. Cong. Irrig. and Drain. Trans. 5(2): R.15.153-R.15.169. 1963. 55.9 C7652

A report was given on the economic analysis of irrigation and drainage plans in Japan.

2196. Salamin, P. SURFACE DRAINAGE AND STORAGE IN PLAIN CATCHMENTS. (Fr) Cong. Irrig. and Drain. Trans. 4(3): 11.333-11.352. 1960. 55.9 C7652
English summary.

The solution of the problems encountered in the development of surface drainage and storage for plain catchment areas in Hungary was discussed.

2197. Salmon de la Jara, P. PILOT PLAN FOR DRAINAGE IN PIURA. (Sp) Vida Agr. [Lima] 33(396): 905, 907-908. Nov. 1956. 9.8 V66

2198. Santing, G. GROUND WATER MODELS. (Du) Cent. Organ. v. Toegepast-Natwetensch. Onderz. Verslagen van de Tech. Bijeenkomst. 17: 23-47. 1963. 292.9 C33
English summary.

A report was given on ground water models used in the Netherlands to help solve practical problems of ground water flow.

2199. Savarenskii, A. D. DRAINAGE MEASURES BASED ON THE CONSTRUCTION OF VERTICAL ISOLATION AND INTERCEPTING LOCKS. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOVHENNYKH POCHV, 1955. Trudy, Minsk, pp. 104-109. 1956. 54.9 K83

2200. Savarenskii, A. D. HYDROTECHNICAL DESIGN OF AN IRRIGATION AND DRAINAGE SYSTEM, WITH THE AUTOMATIC REGULATION OF WATER. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 87: 37-43. Ref. 1963. 20 M857

2201. Saveson, I. L. AN EFFICIENT DRAINAGE SYSTEM FOR SUGARCANE. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-72, 12 pp. Mar. 1963. A56.9 R31

Research was reported on the design, construction, and use of an efficient drainage system for sugarcane in Louisiana.

2202. Sayre, W. W., and Albertson, M. L. ROUGHNESS SPACING IN RIGID OPEN CHANNELS. Amer. Soc. Civil Engin. Trans. 128(1): 343-372. 1963. 290.9 Am3

A series of experiments to determine the effect of roughness spacing on open channel flow was reported. The experiments were conducted in an 8-foot wide by 72-foot-long adjustable-slope flume. Roughness elements consisting of sheet metal baffles were placed on the bed of the flume at various longitudinal and transverse spacings.

The data were analyzed in terms of the von Karman-Prandtl concepts of turbulent flow near a rough boundary. Logarithmic flow formulas were developed in which the roughness factor is related to the size and spacing characteristics of the roughness elements.

With discussion by Messrs. P. F. Biery and J. W. Delleur; Jamil Malaika; T. Blench; Donald R. F. Harleman and Ralph R. Rumer, Jr.; Walter Rand; Jacob Davidian and Rolland W. Carter; John A. Roberson; Herman J. Koloseus; Ralph W. Powell; Dean F. Peterson, Jr.; and William W. Sayre and Maurice L. Albertson. pp. 372-419.

2203. Schenck, H., Jr. SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER. J. Geophysical Res. 68(20): 5739-5745. Oct. 15, 1963. 470 J823

The techniques of Monte-Carlo or random-walk computer simulation, applied with considerable success in nuclear and molecular physics, can also be utilized to generate hypothetical drainage-basin networks. Stream direction within the basin is controlled entirely by random choice, subject only to the constraints that reverse flow and closed loops are not permitted. A program suitable for the IBM 1620 digital computer was described that will generate a rectangular basin of 600 area units. Resulting networks were analyzed and the results were compared with field data. The computer-generated networks compare very closely with natural streams as regards stream lengths and numbers of streams of various order. Comparison was also made with Gray's area-length correlation. Although there was considerable scatter in the computer data, Gray's law was roughly predicted by the random-walk models.

2204. Schijf, J. B. DELTA PROJECT: GENERALITIES ON COASTAL PROCESSES AND PROTECTION. Amer. Soc. Civil Engin. Trans. 125: 1268-1278. 1960. 290.9 Am3

The engineering basis of coastal protection was examined in general with some emphasis on experience on the seacoast of the Netherlands. The paper supported a shift in the old philosophy of protection by groins and seawalls to a new philosophy of protection by sand fill.

With discussion by Messrs. Richard Silvester; and Johannes B. Schijf. pp. 1278-1280.

2205. Schimming, B. B., and Kondner, R. L. AUXILIARY POTENTIAL FUNCTION FOR SEEPAGE. J. Irrig. and Drain. Div., ASCE 90(IR 2): 21-32. June 1964. 290.9 Am3Ps

The use of an auxiliary potential function for the purpose of simplifying the numerical analysis of seepage through a nonhomogeneous media was shown to be advantageous. Instead of having to guess at initial trial values for such systems which invariably increase the computational effort required, a systematic procedure demanding a minimum of numerical calculation for any spatial variation in the coefficient of a permeability of the conducting medium is available. For maximum utility, the a priori knowledge of a solution for a homogeneous medium is required. A particular case involving a two-layer system was given to illustrate the technique.

2206. Schirmer, M., and Mock, F. J. MEASUREMENT OF DITCHES IN LAND CULTIVATION, ESPECIALLY DITCHES WITH CULVERTS. (Ge) Wasser u. Boden. 11(1): 11-14. Jan. 1959. 56.8 W28

2207. Schleusener, R. A., and Corey, A. T. THE ROLE OF HYSTERESIS IN REDUCING EVAPORATION FROM SOILS IN CONTACT WITH A WATER TABLE. J. Geophysical Res. 64: 469-475. 1959. 470 J823

Evaporation studies were conducted on three soil types in contact with a water table. For conditions of high evaporativity or increased depth to the water table, it was found that evaporation from the soils was not always in proportion to the rate of evaporation from a free-water surface. Under some conditions there was an inverse relation between evaporation from the soils and that from the free-water surface.

A capillary tube model was used to explain qualitatively these results on the basis of reversals of changes in pressure in the soil water. This hysteresis phenomenon was believed to be responsible for reducing evaporation from soils in contact with a water table.

2208. Schmid, P., and Luthin, J. THE DRAINAGE OF SLOPING LANDS. J. Geophysical Res. 69(8): 1525-1529. Apr. 15, 1964. 470 J823

The problem of the water table in equilibrium with the rainfall on sloping land was analyzed by solving Boussinesq's equation. It was assumed that the hillside is drained by parallel ditches which are founded in an impervious layer. A nomogram was presented for calculating the ditch spacing as a function of replenishment, soil hydraulic conductivity, and maximum height of the water table above the impermeable layer.

2209. Schmitt. WATER DEPLETION BY DRAINAGE. (Ge) Land-u. Hauswirt. Auswertungs-u. Informdienst. [Veroffentl.] 124, Ed. 2, 7 pp. 1957. 18 G312V

2210. Schmitt. WATER REMOVAL THROUGH DRAINAGE. (Ge) Land-u. Hauswirt. Auswertungs-u. Informdienst. [Veroffentl.] 124, rev., various paging. 1961. 18 G312V

2211. Scholz, A. RECOMMENDATIONS FOR THE PRACTICAL APPLICATION OF MOLE DRAINAGE ON LOWER MOOR SITES. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(6): 262-265. June 1964. 18 W763

2212. Schonberg, W., and Lorenz, P. DRAINAGE OF SOILS WITH DAMMED-UP WATER. (Ge) Deut. Landwirt. 13(9): 433-436. Sept. 1962. 18 D4822

2213. Schwab, G. O. HOW MUCH WATER DO DRAIN TILES REMOVE? Ohio Farm and Home Res. 46(2): 20-22. Mar./Apr. 1961. 100 Oh3S

A report was given on the amount of water removed by drain tiles on a Nappanese silt loam soil at Tiffin, Ohio under a crop rotation system.

2214. Schwab, G. O. SPACING TILE DRAINS. Ohio Farm and Home Res. 49(1): 6-7, 11. Jan./Feb. 1964. 100 Oh3S

A discussion was given on the spacing of tile drains in Ohio. The effect of surface drainage on tile flow was reported.

2215. Schwab, G. O., Fouss, J. L., and Leech, A. P. RATE, DURATION, AND FREQUENCY OF TILE FLOW. Agr. Engin. 42(10): 546-549, 555. Oct. 1961. 58.8 Ag83

Eight years of tile flow records at Tiffen, Ohio, were evaluated for drains at 2 and 3-feet depths and at spacings of 30 and 60 feet in all combinations. The crops included corn, small grain, and first and second year meadow.

2216. Schwab, G. O., Kirkham, D., and Johnson, H. P. EFFECT OF TILE SPACING ON CROP YIELDS AND WATER TABLE LEVEL IN A PLANOSOL SOIL. Soil Sci. Soc. Amer. Proc. 21(4): 448-452. 1957. 56.9 So3

Six years of data were presented on the effect of tile drainage in a Planosol soil (claypan soils of flat lands) at spacings of 15, 30, and 60 feet.

2217. Schwab, G. O., Manson, P. W., Luthin, J. N., and Reeve, R. C. ENGINEERING FOR LAND DRAINAGE—GENERAL. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 287-399. 1957. 4 Am392

A discussion was given on the engineering requirements for subsurface drainage.

2218. Schwab, G. O., and Thiel, T. J. HYDROLOGIC CHARACTERISTICS OF TILE AND SURFACE DRAINAGE SYSTEMS WITH GRASS COVER. Trans. ASAE 6(2): 89-92. 1963. 290.9 Am32T

Research results were reported from replicated drainage plots established on heavy clay soil and planted to tall fescue near Sandusky, Ohio, to evaluate various systems of drainage. The average rate of drop of the water table for the first two days following irrigation was 0.52 feet per day for tile drainage only, 0.55 feet per day for surface drainage only, and 0.67 feet per day for the combination tile and surface drainage. In the undrained plot, drop in water level at the surface was only about 0.04 feet per day.

2219. Schwab, G. O., Thiel, T. J., Taylor, G. S., and Fouss, J. L. TILE AND SURFACE DRAINAGE OF CLAY SOILS. I. HYDROLOGIC PERFORMANCE WITH GRASS COVER. Ohio. Agr. Expt. Sta. Res. B. 935, 48 pp. Apr. 1963. 100 Oh3S

A report was given on replicated drainage systems established on heavy clay lakebed soil near Sandusky, Ohio. Surface drainage greatly reduced tile flow and tile drainage reduced surface flow volumes about the same amount.

2220. Schwartz, G. M., and Manson, P. W. POTHOLE DRAINAGE AND DEEP GROUND WATER SUPPLIES. Minn. Farm and Home Sci. 21(3): 13-15. map. Spring 1964. 100 M668

A discussion was given on the effect of pothole drainage on deep ground water supplies in Minnesota. Preliminary results have indicated that the drainage of potholes in highly impervious surroundings had little effect on the deep ground water reservoir.

2221. Schwendinger, E. SOIL IMPROVEMENT RESEARCH STATIONS FUSSACH AND HOCHST IN THE VORARLBERG RHINE DELTA. (Ge) Bodenkultur. 13(1): 59-71. maps. Apr. 1962. 19 B635 English summary.

A report was given on soil improvement research stations in Austria and drainage experiments conducted there.

2222. Scott, D. F. FLOOD GATES FOR DRAINAGE OUTLETS. New Zeal. J. Agr. 100(5): 473, 475. May 16, 1960. 23 N48J

A report was given on the use in New Zealand of flood gates for drainage outlets into rivers where the water level may rise temporarily due to flooding.

2223. Scott, E. J., and Hanks, R. J. SOLUTION OF THE ONE-DIMENSIONAL DIFFUSION EQUATION FOR EXPONENTIAL AND LINEAR DIFFUSIVITY FUNCTIONS BY POWER SERIES APPLIED TO MOISTURE FLOW IN SOILS. Soil Sci. 94(5): 314-322. Nov. 1962. 56.8 So3

A method for solving the one-dimensional diffusion equation for exponential and linear diffusivity functions by power series was devised. The method was programmed for the IBM 650. Results were shown for horizontal infiltration and outflow in seim-infinite systems for both functions.

2224. Scott, E. J., Hanks, R. J., Peters, D. B., and Klute, A. POWER SERIES SOLUTIONS OF THE ONE-DIMENSIONAL FLOW EQUATION FOR EXPONENTIAL AND LINEAR DIFFUSIVITY FUNCTIONS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-64, 39 pp. Sept. 1962. A56.9 R31

Examples of power series solutions of one-dimensional flow equations for exponential and linear diffusivity functions were given. A computer was utilized for making these solutions.

2225. Seino, T. STUDIES ON LAND IMPROVEMENT BY PUMPED DRAINAGE IN THE LOW AND WET LAND. (Ja) Nogyodoboku-Kenkyu. 30(4): 201-209. Dec. 1962. 290.8 N68
English summary.

A report was given on drainage design for pumped drainage in the low and wet land in Japan.

2226. Seino, T. ADJUSTMENT OF DRAINAGE BY STORING WATER IN PADDY FIELDS—AN EXAMPLE OF KURUMABA AREA, NIIGATA PREFECTURE. Cong. Irrig. and Drain. Trans. 5(6): R.18.141-R.18.154. 1963. 55.9 C7652

A report was given on an adjustment of drainage by storing water in paddy fields in Japan.

2227. Semenov, K. S. KIEV INSTITUTE OF HYDRAULIC ENGINEERING DURING THE YEARS OF SOVIET POWER. (Rus) Gidrotekh. i Melior. 10(3): 35-39. Mar. 1958. 290.8 G362

2228. Sen, S. DRAINAGE STUDY OF LOWER DAMODAR VALLEY. Calcutta, India J. Power and River Valley Devlpmt. 65 pp. 1957. 54 Se5

A report was given of a drainage study of the lower Damodar Valley in India.

2229. Sen, S. DRAINAGE STUDY OF LOWER DAMODAR VALLEY. III. India J. Power and River Valley Devlpmt. 7(6): 15-25. June 1957. 292.48 In2

The results of a study of drainage needs in the Lower Damodar Valley in India due to sediment from erosion in streams, and the effects of tides, rainfall, and ground water fluctuations in the area were given.

2230. Sepp, M., and Maastik, A. HYDRAULIC STUDY OF SLOPES PLANTED WITH GRASSES. (Rus) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 31: 50-60. 1963. 106 Es83
German summary.

2231. Sewell, J. I., and van Schilfgaarde, J. DIGITAL COMPUTER SOLUTIONS OF PARTIALLY UNSATURATED STEADY-STATE DRAINAGE AND SUBIRRIGATION PROBLEMS. Trans. ASAE 6(4): 292-296. Ref. 1963. 290.9 Am32T

A computer program in parametric form was reported whereby a variety of drainage, and subirrigation problems can be solved, taking into account flow above as well as flow below a water table. The technique is more versatile than sand tank models and more accurate than electric analogs.

2232. Shaumian, V. A. PRINCIPLES OF UTILIZING IRRIGATION AND DRAINAGE SYSTEMS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury, 1956. 461 pp. 1956. 55 Sh240

2233. Shaw, R. H., and Runkles, J. R. SOIL MOISTURE AND WATER UTILIZATIONS IN IOWA. Agron. J. 48(7): 313-318. July 1956. 4 Am34P

Average water loss per day by runoff, percolation, and evapotranspiration was 0.04 to 0.05 in winter and 0.18 to 0.20 inches in summer from samples taken in Iowa between Feb. 1954 and Nov. 1955. There was little change in soil moisture content in winter. Small gains in Spring were greater in corn than meadow. Decrease in summer was greater under corn than meadow, amounting to 3 to 4 inches. Normal rainfall increased soil moisture content 2 to 3 inches in late summer and fall.

2234. Shchipakin, V. P. RATIONALE OF REGULATING ELEMENTS OF DEEP DRAINAGE SYSTEM AND OF TEMPORARY ELEMENTS OF AGRO-MELIORATIVE SYSTEM. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 145-153. 1962. 20 M857

2235. Shchipakin, V. P. ADVISABILITY OF CONNECTING DRAINAGE TILES WITH FLEXIBLE MUFFS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 87: 193-199. Ref. 1963. 20 M857

2236. Shkinkis, T. THE EFFECT OF DRAINAGE INTENSITY OF THE WATER REGIME OF LOAMY PODZOL SOILS. (Rus) Int. Congr. Soil Sci. Paper. 8: 64-82. Ref. 1964. 56.09 In848Do
German summary.

2237. Shull, H. HYDRAULIC CHARACTERISTICS OF GLASS-FIBER FILTER MATERIALS. Trans. ASAE 7(2): 120-122. 1964. 290.9 Am32T

A report was given on the hydraulic characteristics of fiber glass filter materials for tile drainage systems in California.

2238. Shumakov, B. A., and Laptev, V. N. PROBLEM OF DEPTH OF THE DRAINAGE CANALS ON THE RICE FIELDS. (Rus) Sel'sk. Khoz. Sev. Kavkaz. 1960(2): 66-69. Feb. 1960. 20 Se495

2239. Sieben, W. H. RELATION BETWEEN DRAINAGE CONDITIONS AND CROP-YIELD FOR YOUNG LIGHT CLAY SOILS IN THE NOORDOOSTPOLDER. (Du) Van Zee Tot Land. 40, 117 pp. Ref. 1964. 54.8 V26
English summary.

A report was given on the research for the design of drainage systems on Noordoost polder in the Netherlands.

2240. Silvester, R. HYDRAULIC JUMP IN ALL SHAPES OF HORIZONTAL CHANNELS. J. Hydraul. Div., ASCE 90 (HY 1): 23-55. Jan. 1964. 290.9 Am3Ps

A simple analytical solution was presented of the ratios of conjugate depth and energy loss in terms of the upstream Froude number for the hydraulic jump in horizontal rectangular, triangular, parabolic, circular, and trapezoidal channels. A semi-empirical solution was provided for the jump length in the same sections. Verification was obtained from other exact solutions for certain shapes and from experimental data available on all sections. The correlation was good, although further tests were indicated for certain channel shapes, especially in regard to jump length.

2241. Simmons, W. P. TRANSITIONS FOR CANALS AND CULVERTS. J. Hydraul. Div., ASCE 90(HY 3): 115-153. May 1964. 290.9 Am3Ps

Results of model studies of variations in open-type inlet and outlet transitions for small canals and culverts were presented. Lower losses and better performance resulted when closed-conduit sections were added between the pipelines and transitions. Best results were obtained with a 6-diameter-long closed-conduit transition that terminated in a headwall normal to the canal centerline.

2242. Simon, A. L. TRAVEL TIME OF WAVES IN BACKWATERS. J. Hydraul. Div., ASCE 89(HY 6): 1-13. Nov. 1963. 290.9 Am3Ps

Time of travel of elementary waves in prismatic channels with gradually varied flow was expressed by two parametric equations. The first equation gives the travel time over a reach. The second equation, which is analogous to Bakhmeteff's backwater function, gives the appropriate flow parameters of the reach. Parameters are the actual and normal Froude numbers. The simultaneous solution of the two equations furnishes the initial conditions for flood routing computations using the method of characteristics.

2243. Simons, D. B., and Albertson, M. L. UNIFORM WATER CONVEYANCE CHANNELS IN ALLUVIAL MATERIAL. Amer. Soc. Civil Engin. Trans. 128(1): 65-107. Ref. 1963. 290.9 Am3

Methods of designing uniform alluvial channels were developed and illustrated. Design theories which were recommended include: (1) A modification of the regime theory of India; and (2) a modification of the tractive-force theory. Special emphasis was given to the modified regime theory. The results were based on a field study of stable alluvial irrigation channels, and other existing alluvial channel data which were applicable.

With discussion by Messrs. Gerald T. Lacey; Peter Ackers; G. Kalkanis; John F. Kennedy; T. Blench; Claude Inglis; Marcel Bitoun; Monir M. Kansoh; Serge Leliavsky; and Daryl B. Simons and Maurice L. Albertson. pp. 107-167.

2244. Simons, D. B., and Richardson, E. V. FORMS OF BED ROUGHNESS IN ALLUVIAL CHANNELS. Amer. Soc. Civil Engin. Trans. 128(1): 284-302. 1963. 290.9 Am3

Laboratory experiments in a large recirculating flume, in addition to field studies, have established that resistance to flow and sediment transport to alluvial channels are related to the form of bed roughness. The forms of bed roughness that have been observed in the laboratory flume and in natural alluvial channels can be divided into two regimes of flow, on the basis of their shape, resistance to flow, and sediment transport. These divisions are the lower flow regime and the upper flow regime. Between the two regimes there is a transition zone. The bed forms are ripples and dunes in the lower flow regime and plane bed, standing waves, and antidunes in the upper flow regime. The bed form in the transition zone is variable, ranging from that which is typical of the lower flow regime to that for the upper regime.

With discussion by Messrs. C. F. Nordin, Jr., and J. K. Culbertson; Alan V. Jopling; Vito A. Vanoni and John F. Kennedy; and D. B. Simons and E. V. Richardson. pp. 303-323.

2245. Simons, D. B., Richardson, E. V., and Haushild, W. L. DEPTH-DISCHARGE RELATIONS IN ALLUVIAL CHANNELS. J. Hydraul. Div., ASCE 88(HY 5): 57-72. Sept. 1962. 290.9 Am3Ps

Resistance to flow in an alluvial channel is extremely variable. The magnitude of the variations in terms of the Manning n may be as large as 300 percent because the roughness elements are formed by the interaction between flow, fluid, and sediment. The variation in resistance to flow, in addition to other factors such as scour or fill, may preclude obtaining a stage-discharge relation that is stable enough to be useful for some alluvial channels. A usable depth-discharge relation may be obtained, particularly the relation that occurs in the upper flow regime, if depth is used instead of stage and the changes in flow pattern and resistance to flow that occur with changes in the bed form are known.

The type and shape of depth-discharge curve for a given alluvial channel primarily depends on the following: Slope; variation in discharge; characteristics of the bed material, including fall velocity, which depends on the viscosity or apparent viscosity of the fluid; the rate of change of discharge with time; longitudinal and lateral variation in the bed material; depth and energy gradient; and, to a lesser extent, the effects of vegetation, wind, and seepage forces.

2246. Sine, L. DESIGN OF TILE DRAINAGE SYSTEMS WITH REFERENCE TO THE HYDRODYNAMIC CHARACTERISTICS OF SOILS AND THE DRAINAGE REQUIREMENTS. General Report. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 33-42. Ref. 1958, pub. 1960. 290.9 C765C
English summary.

A report was given on the design of drainage systems using the hydrodynamic characteristics of soils and the drainage requirements of the crops to be grown.

2247. Sine, L., and Meinguet, J. CONTRIBUTION TO THE HYDRAULIC STUDY OF DRAINAGE SHEETS. I. (Fr) Inst. Agron. et Sta. de Rech. de Gembloux. B. 26(1/3): 208-234. Ref. 1958. 105.1 G285

2248. Sine, L., and Vermeiren, L. CONTRIBUTION TO THE HYDRAULIC STUDY OF DRAINAGE SHEETS. II. VARIABLE SYSTEM. (Fr) Gembloux. Inst. Agron. de l'Etat. B. 32(3): 405-425. Ref. 1964. 105.1 G285

2249. Sisson, D. R. IS YOUR DRAINAGE GOOD ENOUGH? Hoard's Dairyman. 105(16): 827, 842-843. Aug. 25, 1960. 44.8 H65

A discussion was given on the need and use of good drainage practice for tile drainage.

2250. Sittner, W. T. EXTENSION OF RATING CURVES BY FIELD SURVEYS. Amer. Soc. Civil Engin. Trans. 129: 286-287. 1964. 290.9 Am3

A digest was of an article, discussion, and the closing on the extension of rating curves by field surveys. The original article was published in J. Hydraul. Div., ASCE (HY 2): 1-9. Mar. 1963. References to the discussions and closure were listed.

2251. Skoropanov, S. G. RATES OF DRAINAGE OF PEAT-MARSHY SOILS. (Rus) Gidrotekh. i Melior. 1962(1): 34-40. Jan. 1962. 290.8 G362

2252. Skoropanov, S. G. NORMS OF DRAINAGE AND CROP PATTERNS. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 2: 27-30. Ref. Feb. 1964. 20 V633
English summary.

A report was given on the experience of drainage of boggy areas in Byelorussian S.S.R.

2253. Slee, J. E. THE DRAINAGE OF FARM LANDS. Power Farming Austral. and New Zeal. 65(8): 37, 39, 41, 43, 45, 47. Aug. 1956. 58.8 P87

A report was given on the drainage of farm lands in New Zealand.

2254. Sluis, W. T., and Franke, A. THE USE OF SURVEYING EQUIPMENT IN LAND LEVELLING. (Du) Nederland. Heidemaatschr. Tijdschr. 68(3): 72-73. Mar. 1957. 12 N282

2255. Smerdon, E. T., and Beasley, R. P. THE TRACTIVE FORCE THEORY APPLIED TO STABILITY OF OPEN CHANNELS IN COHESIVE SOILS. Mo. Agr. Expt. Sta. Res. B. 715, 36 pp. 1959. 100 M693

The tractive force theory presents a logical criterion by which the problem of the stability of open channels in cohesive soils can be investigated.

Eleven Missouri soils were selected for the tests. The soils ranged from a silty loam soil with little cohesion to a highly cohesive clay soil. The plasticity indexes of the soils ranged from 6.6 to 44.1.

The data from the hydraulic tests and physical tests on the soils were analyzed statistically to determine the significance of the apparent correlation between critical tractive force and pertinent soil properties. For the soils tested, the critical tractive force was found to be well correlated with each of the following soil properties: (1) The plasticity index; (2) the dispersion ratio; (3) the mean particle size; and (4) the percent clay. A less significant correlation existed between critical tractive force and the phi-mean particle size.

2256. Smerdon, E. T., and Beasley, R. P. CRITICAL TRACTIVE FORCES IN COHESIVE SOILS: STUDIES SUPPORT THEORY IN EVALUATING STABILITY IN OPEN CHANNEL DESIGN. Agr. Engin. 42: 26-29. 1961. 58.8 Ag83

Stability is of great importance in any field of engineering concerned with the design of open channel water conveyance systems. To date the following criteria have governed the design of open channels: The concept of limiting velocities; the regime theory; and the tractive force theory. The first two of these are strictly empirical in nature, while the latter is primarily theoretical in that it offers a way to evaluate shear at the interface of flowing water and the channel bed material. However, for open channels constructed in cohesive soils, the relationship between boundary shear and soil movement has not been adequately determined.

2257. Smith, E. A. L. PILE-DRIVING ANALYSIS BY THE WAVE EQUATION. Amer. Soc. Civil Engin. Trans. 127(1): 1145-1171. 1962. 290.9 Am3

There are a great many different pile-driving formulas in use, and engineers have never been able to agree as to which one is best. This situation has arisen primarily because, until recently, the mathematics of pile-driving action could not be solved in any practical manner. As a result all pile-driving formulas are partly empirical and, consequently, apply only to certain types or lengths of pile. This paper is presented with the purpose of giving engineers a mathematical method of wider application, depending on the use of electronic computers and numerical integration. The method is also applicable to other impact problems.

With discussion by Messrs. L. O. Soderberg; Marvin Gates; E. Jonas; A. A. Eremin; G. M. Cornfield; Robert D. Chellis and Arthur F. Zaskey; and E. A. L. Smith. pp. 1171-1193.

2258. Smith, O. E., and Beville, B. C. DRAINAGE OF CITRUS LAND IN FLORIDA. (Condensed.) Agr. Engin. 45(12): 674-675. Dec. 1964. 58.8 Ag83

A discussion was given on drainage requirements of citrus land in Florida. The installation and maintenance of tile drainage were discussed.

2259. Smith, R., and Robertson, V. C. THE SURVEY OF SOILS, VEGETATION AND WATERS OF WATERLOGGED AND MARSHY LANDS BEFORE RECLAMATION, WITH SPECIAL REFERENCE TO THE ELEPHANT MARSH OF NYASALAND. Cong. Irrig. and Drain. Trans. 4(3): 11.371-11.392. 1960. 55.9 C7652

The studies needed to determine the feasibility of draining the Elephant marsh in Nyasaland for reclamation and possible irrigation development were reported. It was concluded that if the marsh was reclaimed it would be suitable for climatically adapted crops such as sugarcane, rice, tropical fruits, etc.

2260. Smith, R. M., and Henderson, R. C. SOME INTERPRETATIONS OF RUNOFF AND EROSION FROM TERRACES ON BLACKLAND SOIL. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-42, 15 pp. May 1961. A56.9 R31

A summary of the terrace results at the Blackland Experiment Station at Temple, Tex., was given as a basis for suggested improvements in conservation practices and planning.

2261. Snodgrass, G. F. DESIGNING A PUMPING SYSTEM FOR FLOOD CONTROL IN THE EVERGLADES. (Condensed) Agr. Engin. 44(11): 616-617, 619. Nov. 1963. 58.8 Ag83

A report was given on designing a pumping system for flood control in the Everglades of Florida.

2262. Soden, R. W. THE WAYS AND MEANS OF FARMSTEAD DRAINAGE. Great Britian Min. Agr. Fisheries and Food Agr. 71(1): 22-26. Jan. 1964. 10 G79J

A report was given on farmstead drainage requirements in Great Britian.

2263. Someren, C. L. Van. THE PRESENT SITUATION OF DRAINAGE TECHNIQUE. (Du) Landbk. Tijdschr. 74(2): 70-77. Jan. 1962. 105.2 Or3

2264. Spencer, R. T. THE FARM HOME; DRAINAGE IN THE HOME GARDEN. Agr. Gaz. N.S. Wales. 75(6): 1110-1112. June 1964. 23 N472

A report was given on the planning and use of drainage in the home garden in New South Wales, Australia.

2265. Stamp, L. D. THE ENGINEER TO THE RESCUE. World Crops. 9(5): 183-186. May 1957. 281.8 W892

A report was given on the engineering requirements and equipment for the reclamation of tidal swamps and low lying areas.

2266. Stankevich, V. S. RECLAMATION METHODS OF THE FAR EAST LANDS. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 7: 60-69. July 1964. 20 V633
English summary.

A report was given on the use of open drain tile drainage, mole drainage, and ridges and furrows for reclamation of land in the Far East.

2267. Starikov, K. N. DEEP DRAINAGE OF LOW-LAND BOGS OF THE MESHCHERA. (Rus) Gidrotekh. i Melior. 11: 41-48. Ref. Nov. 1962. 290.8 G362

2268. Staveren, J. M. Van. THE INTERNATIONAL INSTITUTE FOR LAND RECLAMATION AND IMPROVEMENT. Way Ahead. 6(4): 2-4. 1957/59. 280.8 W362

A report was given on the drainage research conducted at the International Institute for Land Reclamation and Improvement.

2269. Staveren, J. M. Van. THE INTERNATIONAL INSTITUTE FOR LAND RECLAMATION AND IMPROVEMENT AT WAGENINGEN. (Du) T.N.O.-Nieuws. 13(3): 114-118. Mar. 1958. 475 T11

2270. Stephens, J. C., Blackburn, R. D., Seaman, D. E., and Weldon, L. W. FLOW RETARDANCE BY CHANNEL WEEDS AND THEIR CONTROL. J. Irrig. and Drain. Div., ASCE 89(IR 2): 31-47. June 1963. 290.9 Am3Ps

The proper maintenance of canals infested with aquatic weeds presents serious problems when attempting to achieve design flow in waterways through the flat, fertile lands of the Southeastern United States. Floating waterweeds raise the coefficient of roughness, n, to more than twice the clean-channel value, based on equal cross-sectional areas and channel geometry. Submersed weeds, such as southern naiad, can raise infested, as compared to clean, values almost twentyfold.

Submersed weeds were controlled by constructing channels with sufficient depth to exclude sunlight at the bottom where these plants take root. Limited control was achieved by biological agents such as herbivorous fishes, mammals, or insects. Mechanical means of control such as dredging, dragging, and cutting have been widely used. Most mechanical methods provided control only for short periods and often induced spreading of the infestation to other areas.

2271. Stephens, J. C., Blackburn, R. D., Seaman, D. E., and Weldon, L. W. FLOW RETARDANCE BY CHANNEL WEEDS AND THEIR CONTROL. Amer. Soc. Civil Engin. Trans. 129: 724-726. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a research study on the flow retardance by channel weeds. The use was discussed of channel design, biological methods, mechanical method, and chemical method to control aquatic weeds in drainage and irrigation channels. The original publication was published in J. Irrig. and Drain. Div., ASCE 89(IR 2): 31-53, June 1963. References to the discussions and closure were listed.

2272. Sternberg, I. DRAINAGE STUDIES FROM AERIAL SURVEYS. Photogram. Engin. 27(4): 638-644. map. Sept. 1961. 325.28 P56

The use of steroscopic pairs of aerial photographs was recommended for field engineers, with limited photogrammetric training, to determine drainage areas for estimating culvert sizes for highway drainage. These photographs can also be used for actual positioning of culverts, bridges, dikes, channel changes, and similiar features of design to use as a guide for construction plans and estimates.

2273. Straub, L. G., and Anderson, A. G. SELF-AERATED FLOW IN OPEN CHANNELS. Amer. Soc. Civil Engin. Trans. 125: 456-481. 1960. 290.9 Am3

Measurements of distribution of air concentration in self-aerated flows were presented. The experiments were made in a rough channel of sand-grain type surface at various slopes and discharges, and the data were used as a basis for study of the mechanism of entrainment of air and to relate the air content and distribution to the characteristics of the flow. The analysis of the data showed that the air distribution can be adequately described by relationships based on a simplified concept of turbulent transport and thus are functions of the flow characteristics. The maximum depth and the mean velocity were both shown to increase above those of a corresponding nonaerated flow.

2274. Straub, L. G., and Lamb, O. P. STUDIES OF AIR ENTRAINMENT IN OPEN-CHANNEL FLOWS. Amer. Soc. Civil Engin. Trans. 121: 30. 1956. 290.9 Am3

The results were described of experimental observations of self-aerated flows in an open channel for various slopes of from 15° to 45°. It was pointed out that customary open-channel flow relationships do not apply directly to air-entrained flows. For the range of conditions reported, actual velocities were shown to be greater than the velocities computed by hitherto proposed methods. The experiments reported were for the conditions of a smooth, painted-steel channel surface.

2275. Straub, L. G., Silberman, E., and Nelson, H. C. OPEN-CHANNEL FLOW AT SMALL REYNOLDS NUMBERS. Amer. Soc. Civil Engin. Trans. 123: 685-706. 1958. 290.9 Am3

A summary and correlation were presented of the results of several theses studies on open-channel flow in a range of Reynolds numbers less than approximately 4×10^4. The hydraulic diameter was used as the length parameter in the Reynolds numbers. Smooth laminar flow, smooth turbulent flow, rough laminar flow, and rough turbulent flow were considered separately, as was transition from laminar flow to turbulent flow in smooth channels.

With discussion by Messrs. Wallace M. Lansford and James M. Robertson; Chesley J. Posey; and Lorenz G. Straub, Edward Silberman, and Herbert C. Nelson. pp. 707-714.

2276. Stryjewski, F. DEPTH AND ROW DISTANCE IN TILE DRAINAGE. (Pol) Wiad. Melior. i Lakarskie. 6(4): 90-92. July/Aug. 1963. 54.8 W63

2277. Sun, C. K., and Mai, C. C. HOW TO TAKE CARE OF FLOODED ORCHARDS. (Ch) Nongye Jishu. 11: 20-21. Nov. 1963. 22.5 N929

2278. Sutton, J. G. A REPORT ON DRAINAGE PROBLEMS AND ACTIVITIES PREPARED FOR TOPRAKSU. 36 pp. [n.p. 1962?] 54 Su82

A report was given of drainage problems and activities in Turkey.

2279. Swartzendruber, D. WATER FLOW THROUGH A SOIL PROFILE AS AFFECTED BY THE LEAST PERMEABLE LAYER. J. Geophysical Res. 65(12): 4037-4042. Ref. Dec. 1960. 470 J823

Water movement through a water-saturated soil profile was analyzed on the basis of Darcy's law for a sectionally continuous hydraulic conductivity along a one-dimensional, downward flow path. The resulting relationships were used to assess the effect of the least permeable layer on the flow through the profile. It was shown that the hydraulic conductivity of the least permeable layer did not of itself control the flow.

A second analysis, based on a quantity defined as the hydraulic resistance, showed that the hydraulic resistance of the least permeable layer controled the flow through the profile with much less error than did the hydraulic conductivity. Furthermore, the error became negligible as the hydraulic resistance of the least permeable layer increased.

2280. Swartzendruber, D. APPROXIMATE WATER FLOW RATES FOR TUBE DRAINS IN STRATIFIED SOILS. J. Geophysical Res. 67(6): 2395-2402. Ref. June 1962. 470 J823

A general theoretical method of approximating the steady-state two-dimensional seepage rate in stratified porous media was applied to tube drainage in layered soils. For drain tubes in a surface soil layer of given permeability overlying an infinitely deep layer of a different permeabilities, the approximate flow rate was within 8 percent of the exact flow rate.

2281. Swartzendruber, D. NON-DARCY FLOW BEHAVIOR IN LIQUID-SATURATED POROUS MEDIA. J. Geophysical Res. 67(13): 5205-5213. Ref. Dec. 1962. 470 J823

Velocity-gradient data for water-saturated porous media were considered in some detail. Deviations from Darcy's law were found in data originally presented in support of the law. Recent data were analyzed on the basis of a postulated three-parameter equation, in contrast with the one-parameter Darcy proportionality. The equation contains Darcy's law as a special case and in general fits the data quite well for water and electrolyte solutions flowing in sandstones and clays.

2282. Swartzendruber, D. NON-DARCY BEHAVIOR AND THE FLOW OF WATER IN UNSATURATED SOILS. Soil Sci. Soc. Amer. Proc. 27(5): 491-495. Ref. Sept./Oct. 1963. 56.9 So3

Corresponding values of flow velocity and moisture gradient were calculated for water flow in unsaturated soil, using a graphical analysis of water into air-dry Salkum silty clay loam. Plots of flow velocity versus moisture gradient were straight lines through the origin at the higher moisture contents, but Darcy proportionality did not hold at the lower moisture contents.

2283. Swartzendruber, D. SEEPAGE INTO STRATIFIED WATER-SATURATED SOIL FROM IDEALIZED VERTICAL MULCH CHANNELS. Soil Sci. Soc. Amer. Proc. 28(3): 314-323. 1964. 56.9 So3

A general theoretical method of approximating the steady-state, two-dimensional seepage rage in stratified porous media was applied to the problem of water flow into stratified water-saturated soil in the presence of idealized subsoil channels. The approximation, estimated to be accurate within 10 percent, was obtained by considering the stratified system in three special, mathematically degenerate cases for which exact solutions were available. When a less permeable surface soil stratum overlaid a more permeable stratum, the flow effect of the channels always exceeded that found for channels in a uniform soil and became quite marked when the channels penetrated the upper, less permeable stratum and extended into the more permeable stratum below.

2284. Swartzendruber, D., and Huberty, M. R. USE OF INFILTRATION EQUATION PARAMETERS TO EVALUATE INFILTRATION DIFFERENCES IN THE FIELD. Amer. Geophysical Union Trans. 39: 84-93. 1958. 330.9 Am3

The infiltration equations $y = At^B$ and $dy/dt = a + b/y$ have appeared in the literature, where y is the quantity of water which will enter a soil when water is applied to the surface, and t is the time. In the present investigation, the constants A, B, a, and b, were considered for their usefulness in characterizing infiltration in field basins on Greenfield loamy sand, a deep soil without profile development. The product parameter AB was compared with a parameter R_T which is simply the average rate over the first two hours of infiltration. The results showed AB to be 40 percent better statistically than R_T. On the other hand, a + 10b, which was superior to a alone and b alone, was essentially no better statistically than R_T.

2285. Tabois, H. G., and Wartena, L. DRAINAGE DISCHARGE UNDER WATER. (Du) Nederland. Heidemaatsch. Tijdschr. 75(4): 210-215. Apr. 1964. 12 N282

2286. Taipei, China Hydraulic Laboratory. MODEL STUDY ON THE SPUR DIKE AND TRAINING DIKE FOR LAND RECLAMATION OF TAHUKOU RIPARIAN LAND. Taipei Hydraul. Lab. Res. B. Ser. A, Hydraul. Model Studies 20, 24 pp. Oct. 1962. 290.9 T13

A report was given on a model study of a spur dike and training dike used for land reclamation in Taiwan.

2287. Takagi, S. RELAXATION METHOD INTERPRETED WITH HYDRAULIC ANALOGY: I. THE CASE OF FIRST BOUNDARY CONDITION; EXCHANGE OF THE WATER PRESSURE CAUSED BY EXCAVATION OF TRAPEZOIDAL DRAIN DITCH IN SEMI-INFINITE GROUND. (Ja) Nogyodoboku-Kenkyu. 26(2): 69-73. July 1958. 290.8 N68

2288. Takagi, S. ANALYSIS OF THE VERTICAL DOWNWARD FLOW OF WATER THROUGH A TWO-LAYERED SOIL. Soil Sci. 90(2): 98-103. Aug. 1960. 56.8 So3

An analysis was given of the vertical downward flow of water through a two-layered soil.

2289. Takagi, S., and Kizaki, S. RELAXATION METHOD INTERPRETED WITH HYDRAULIC ANALOGY: II. CASE OF 2ND BOUNDARY CONDITION; EXCHANGE OF WATER PRESSURE CAUSED BY EXCAVATION OF TRAPEZOIDAL DRAIN DITCH IN SEMI-INFINITE GROUND BOUNDED BY IMPERMEABLE LAYER. (Ja) Nogyodoboku-Kenkyu. 26(3): 145-151. Sept. 1958. 290.8 N68

2290. Takagi, S., and Kizaki, S. RELAXATION METHOD INTERPRETED WITH HYDRAULIC ANALOGY: III. CASE OF THREE DIMENSIONAL SPACE WITH AXIAL SYMMETRY. (Ja) Nogyodoboku-Kenkyu. 26(4): 203-207. Ref. Nov. 1958. 290.8 N68

2291. Talsma, T. THE CONTROL OF SALINE GROUNDWATER. Wageningen. Landbhogesch. Meded. 63(10), 68 pp. Ref. 1963. 105.2 W122

A report was given on the requirements for adequate drainage of irrigated land in Australia to prevent serious salinization of the soil in the root zone.

2292. Talsma, T. TECHNICAL AND ECONOMIC CONSIDERATIONS ON DRAINAGE OR IRRIGATED LAND, IN REGULATION TO SOIL PROPERTIES AND LAND-USE PLANNING. Internatl. Cong. Agr. Engin. 6(II): 215-223. 1964. 290.9 C765C

A report was given on tile drainage criteria for irrigated areas in Australia where saline irrigation water is used.

2293. Talts, A. USE OF AVAILABLE AERIAL PHOTOMATERIAL FOR PREPARATION OF BIG-SCALE BASIC PLANS FOR DRAINAGE OF LAND IN ESTONIAN SSR. (Rus) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 31: 61-72. Ref. 1963. 106 Es83
German summary.

2294. Tanaka, K. ON THE APPROXIMATE SOLUTION FOR DRAINAGE CANALS. (Ja) Saga U. Agr. B. 3: 170-178. Dec. 1955. 107.6 Sa13
English summary.

Methods used in Japan for approximating the most efficient depth and spacing of drainage canals were discussed.

2295. Tanaka, K. STUDIES ON THE SEEPAGE FLOW CONCERNING IRRIGATION AND DRAINAGE. (Ja) Saga U. Agr. B. 13: 87-194. Ref. Aug. 1961. 107.6 Sa13
English summary.

Studies were reported of seepage flow concerning irrigation and drainage in Japan. The relations were discussed between seepage flow and diversion weir, deep well, artesian well, table land, collecting galley, drain lateral, and the velocity measurement of seepage flow.

2296. Task Force. FRICTION FACTORS IN OPEN CHANNELS. J. Hydraul. Div., ASCE 89(HY 2): 97-143. Mar. 1963. 290.9 Am3Ps

The development of fixed-bed, open-channel flow resistance equations was traced from Chezy to the present (1963). The use of the Darcy-Weisbach $\underline{f}$ was recommended, and methods of determining $\underline{f}$ were examined. Manning's $\underline{n}$ was also useful but has limitations that were explained. It gave good results for fully rough flow and smooth channel flow but was less satisfactory in the transition range. The relationship of boundary layers to open-channel resistance must be studied in order to advance the understanding of frictional resistance in open channels. Movable bed channel resistance and the criteria for determining when bed motion begins were reviewed. Further research was recommended in various areas such as definition of equivalent roughness, transition from smooth to fully rough flows for different types of roughness, large relative roughness, composite channels, and resistance with movable beds. A comprehensive bibliography through 1960 was given.

2297. Taylor, G. S. LABORATORY STUDIES TRACE FLOW OF WATER INTO TILE DRAINS. Ohio Farm and Home Res. 41: 36. May/June 1956. 100 Oh3S

Laboratory studies in Ohio were described and illustrated that traced water flow into tile drains.

2298. Taylor, G. S. HOW WATER FLOWS INTO TILE DRAINS. Land Impr. 4(11): 10. Nov. 1957. 282.8 L224

Dyes were used to show drainage conditions from ponded sand and soil material into drain tiles.

2299. Taylor, G. S. DRAINABLE POROSITY EVALUATION FROM OUTFLOW MEASUREMENTS AND ITS USE IN DRAWDOWN EQUATIONS. Soil Sci. 90(6): 338-343. Dec. 1960. 56.8 So3

Procedures were described for determining drainable porosity at equilibrium conditions and nonequilibrium conditions from fluid outflow and water table measurements. The use of drainable porosity equations was discussed, and their evaluation field data was described.

2300. Taylor, G. S., and Luthin, J. N. THE USE OF ELECTRONIC COMPUTERS TO SOLVE SUBSURFACE DRAINAGE PROBLEMS. Hilgardia. 34(12): 543-558. Ref. Aug. 1963. 100 C12H

The procedure for using the computer to solve steady-state drainage problems was described in detail. Flow charts were presented for the solution of problems that include stratified soils. The use of the computer was illustrated by several solutions of ponded flow into stratified soils. The potential use of the computer in other subsurface drainage problems was discussed.

2301. Taylor, G. S., Vimoke, B. S., and Thiel, T. J. ELECTRICAL RESISTANCE NETWORK SPEEDS DRAINAGE RESEARCH. Ohio Farm and Home Res. 46(4): 53-54. July/Aug. 1961. 100 Oh3S

An electrical resistance network used in Ohio to speed drainage research was described and illustrated.

2302. Taylor, G. S., Worstell, R. V., and Luthin, J. N. PONDED WATER FLOW IN LAYERED SOILS. Internatl. Cong. Soil Sci. Trans. 7(1): 480-485. 1960. 56.09 In847T

An analog study of ponded flow into drains was conducted in layered soils. When the drains were located in a layer whose conductivity was low compared to the other two layers, a high percentage of the potential was dissipated very close to the drain.

Without exception, the stream lines intersected the ground surface at smaller horziontal distances from the drain center line in the layered soils than in the homogeneous soils. For a particular conductivity profile, an increase in drain depth caused a stream line to intersect the ground surface at greater horizontal distances from the drain.

When the conductivity ratio of two adjacent layers was less than five, then placement of the drain in the less permeable lower layer did not significantly reduce the drain flow. If the ratio exceeds five, drain flow was greatly reduced when the drain was placed in the less permeable layer.

2303. Teipel, R. TASKS OF MELIORATION AFFAIRS IN THE GERMAN DEMOCRATIC REPUBLIC WITH CONSIDERATION ON PLANNING AND MECHANIZATION. (Ge) Deut. Agrartech. 9(4): 156-161. Ref. Apr. 1959. 58.8 D482

2304. Terrell, P. W., and Borland, W. M. DESIGN OF STABLE CANALS AND CHANNELS IN ERODIBLE MATERIAL. Amer. Soc. Civil Engin. Trans. 123: 101-115. 1958. 290.9 Am3

The design of stable channels in erodible material is complex and depends on the incomplete technical development of open-channel hydraulics, sediment transport, and fluvial morphology. Considerable engineering experience and judgment are required in an approach to this problem. Major factors that must be integrated into the design of a canal were listed and examined. The development and present method of the design of canals were outlined.

Factors causing a change in stream regimen were enumerated. Several methods by which the proper size and shape of a channel can be computed were suggested, and one example was presented.

2305. Thames, J. L., and Ursic, S. J. RUNOFF AS A FUNCTION OF MOISTURE-STORAGE CAPACITY. J. Geophysical Res. 65(2): 651-654. Feb. 1960. 470 J823

Records from small watersheds in northern Mississippi indicated that surface runoff was strongly correlated with storage opportunity in the upper 6 inches of soil. A logarithmic expression was developed to describe these relationships. A procedure for calculating antecedent soil-moisture storage over a watershed was presented.

2306. Theobald, G. H. TWO-WAY CLEARWAY AT THE CULVERT; PROPERLY CONSTRUCTED CROSSINGS OVER OPEN DITCHES AND STREAMS ALLOW FREE PASSAGE OF WATER AND FARM TRAFFIC. Pract. Power Farming. 26(4): 8-9. Apr. 1961. 58.8 P872

A report was given on properly constructed crossings over open ditches and streams in Great Britian.

2307. Theobald, G. H. METHODS AND MACHINES FOR TILE AND OTHER TUBE DRAINAGE. Food and Agr. Organ. United Nations. FAO Agr. Devlpmt. Paper 78, 104 pp. Ref. 1963. 281.9 F733

A report was given on the methods and machinery used for tile and tube drainage.

2308. Thiel, T. J., and Taylor, G. S. UTILIZING A SAND TANK MODEL TO STUDY SOME MOISTURE FLOW PROBLEMS IN DRAINAGE. Internatl. Cong. Soil Sci. Trans. 7(1): 473-479. 1960. 56.09 In847T

A small tank model was described for studying subsurface drainage problems. Provisions were made for varying drain depth and spacing. Glycerine-sand flow systems were used, and fluid pressures were measured at 42 locations during drawdown. By using capillary manometer tubing, reliable measurements of fluid pressure were obtained without using null-type tensiometers. An example of the type of problem which can be studied was illustrated by some experimental findings for drawdown in homogeneous media.

2309. Thorn, R. B. THE DESIGN OF LAND DRAINAGE WORKS. Butterworth, London, 235 pp. maps. Ref. 1959. 54 T39

A collection of eleven selected papers were annotated and arranged in the form of a design handbook. Each paper was revised where necessary by its author to bring the information thoroughly up to date.

2310. Togo, S. HYDRAULIC COMPUTATION AND ECONOMIC DESIGN OF SIDE-CHANNEL SPILLWAY WITH A CONSTANT WATER SURFACE SLOPE. (Ja) Agr. Engin. Soc. (Japan). Trans. 5: 49-52. Jan. 1963. 290.9 Ag8
English summary.

A formula, developed in Japan, of the side-channel spillway with a constant water surface slope was presented where both friction and velocity distribution were considered. A computative example was given and the design of an economical cross-section was discussed.

2311. Toksoz, S., and Kirkham, D. GRAPHICAL SOLUTION AND INTERPRETATION OF A NEW DRAIN-SPACING FORMULA. J. Geophysical Res. 66: 509-516. 1961. 470 J823

A drain spacing formual by Kirkham was presented in graphic and tabulated form.

2312. Tomberg, U. K. DRAINAGE OF SHALLOW PEAT SOILS WITH SANDY UNDERLAYER. (Rus) Gidrotekh. i Melior. 9: 44-48. Sept. 1964. 290.8 G362

2313. Tomomune, T., Hirahara, H., Ogawa, Y., Fujita, N., and Momozumi, T. ON THE TEST DIKE HACHIROGATA RECLAMATION. II. (Ja) Nogyodoboku-Kenkyu. 27(2): 78-83. July 1959. 290.8 N68

2314. Torre, G. CALCULATION OF THE DISTANCES FOR DRAINS WITH CIRCULAR NOMOGRAM. (It) Naples. U. Facol. di Sci. Agr. Ann. (ser. 3) 23: 159-170. 1957/58. 105.4 P83
English summary.

A circular monogram was given to calculate the recommended distances between drain lines for the developement of a drainage system in Italy.

2315. Torre, G. GRAPHICAL COMPUTATION OF THE SPACING OF DRAINS BY MEANS OF A CIRCULAR NOMOGRAPH. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 55-61. 1958, pub. 1960. 290.9 C765C
English summary.

A circular nomograph was presented to give a easy method of determining drain spacings required under various conditions.

2316. Torre, G. ON THE EQUATION OF THE SECTION OF THE HYDRAULIC REBOUND PRODUCED BY VERTICAL WALLS AND WITHOUT INCREASE IN DEPTH. (It) Studi Sassaresi. Sez. III, 10: 175-186. Ref. 1962, pub. 1963. 507 Sa7Sa
French summary.

2317. Torres, C. D. F. DRAINAGE OF SOILS DERIVED FROM THE CENOZOIC SANDS. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 62-71. 1958, pub. 1960. 290.9 C765C
English summary.

A report was given on the proposed technical study and the results acquired 4 years after the drainage network was in operation for draining Cenozoic sand soils of the Gafanha district in Portugal.

2318. Trelease, F. J., and Bittinger, M. W. MECHANICS OF A METHEMATICAL GROUND-WATER MODEL. Amer. Soc. Civil Engin. Trans. 129: 675-677. 1964. 290.9 Am3

A digest was given of an article written on the mechanics of a methematical ground water model that was used, along with a digital computer, to study an aquifer in Colorado. The original article was published in the J. Structural Div., ASCE 89(St 5): 91-116, Oct. 1963.

2319. Trevijano, S. CONTROL OF THE WATER TABLE IN GROUNDS AFFECTED BY GROUND-WATER RUNOFF. Cong. Irrig. and Drain. Trans. 5(5): R.17.213-R.17.228. 1963. 55.9 C7652

A report was given on the control of the water table on grounds affected by ground water runoff.

2320. Troeh, F. R. LANDFORM PARAMETERS CORRELATED TO SOIL DRAINAGE. Soil Sci. Soc. Amer. Proc. 28(6): 808-812. Nov./Dec. 1964. 56.9 So3

A computer study was reported on the correlation of landform parameters to soil drainage. For the six soil types studied, there was a very good correlation between the shape of the land surface and the drainage characteristics of the soil.

2321. Tsinis, E. A. DEEP DRAINAGE OF LOW-LYING MARSHES. (Rus) Gidrotekh. i Melior. 1960(11): 31-35. Nov. 1960. 290.8 G362

2322. Tsonev, I. DETERMINING THE DRAINAGE MODULUS OF SURFACE WATERS BY USING ELEMENTARY DRAINAGE PLATFORMS. (Bu) Akad. Selskostopanskite Nauk. Bulg. Inst. Khidrotekh. Melior. Izv. 4: 17-37. Ref. 1963. 290.9 So2
English summary.

Equations were presented for determining the drainage modulus of surface water for design, irrigation, and drainage systems in Bulgaria.

2323. Tucek, V. CONTRIBUTION TO THE PLANNING OF DRAINAGE DITCHES (TERRACE CHANNELS) ON SLOPING PLOTS. Cong. Irrig. and Drain. Trans. 5(6): C5.63-C5.72. 1963. 55.9 C7652

A report was given on the planning of terraces in Czechoslovakia.

2324. Turbin, V. N. CERTAIN RESULTS OF INVESTIGATING THE DISCHARGE FROM MOLE DRAINS IN HEAVY SOILS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiriazeva. Dok. 48: 71-78. 1959. 20 M857

2325. Turkey Directorate General of State Hydraulic Works. DETERMINING THE RECLAMATION AND DRAINAGE POTENTIAL OF LANDS IN TURKEY. Internatl. Comm. Irrig. and Drain. Annu. B. 1960: 96-100. map. 1960. 55.9 In8A

A report was given on the various methods of land reclamation used in Turkey. Six land classes were described as to their method of reclamation. The recommends land reclamation consists of leaching, admendments, cultural treatments, and/or adequate drainage systems.

2326. Turowski, A. THE WIZNA SWAMP. (Pol) Nowe Roln. 11(20): 25-28. maps. Oct. 15, 1962. 20.5 N86

2327. Ullah, W. SOIL CONSERVATION IN LATERITIC TRACTS OF BIHAR. Indian Forester. 88(12): 913-925. Dec. 1962. 99.8 In2

A report was given on the soil conservation practices used in lateritic tracts in Bihar, India. The design and use of terraces, diversion terraces (interception terraces), and waterways were included in the discussion.

2328. Unger, J. L. THE MATHEMATICAL TREATMENT OF GRID-SURVEY DATA FOR LAND LEVELLING. Netherlands J. Agr. Sci. 11: 264-293. 1963. 12 N3892

The accuracy of the following three methods of calculating the volumes of earth movement for land leveling on account of grid-point data was investigated: Summation; four-point, and stereometric.

Two sources of errors appear to be responsible for the inaccuracies caused by the application of the summation method: (1) A systematic error in grid squares, where cut changes to fill; and (2) a statistical inaccuracy when evaluating the volumes of earth movement in grid squares traversed by the boundaries of the plot to be leveled.

The four-point method was subject to a similar deficiency mentioned under 1, though to a much lesser degree. The stereometric method appears to be free from both deficiencies. In grid squares with all corners either in cut or in fill and not traversed by the plot's boundaries, each calculation method gave the same results.

When the deficiency mentioned under 2 was eliminated, all three calculation methods gave the same earth-work balance for a plot that needed leveling.

2329. U.S. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 16; DRAINAGE--CHAPTER 1. PRINCIPLES OF DRAINAGE. U.S. Soil Conserv. Serv., 31 pp. 1961.

A review of the fundamentals needed by Soil Conservation Technicians whose work includes drainage was given in the first chapter of the Drainage Sections of the SCS National Engineering Handbook.

2330. U.S. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 15; IRRIGATION--CHAPTER 12. LAND LEVELING. U.S. Soil Conserv. Serv., 59 pp. 1961.

A report was given on the SCS procedures for surveying, designing, and installing land leveling jobs to fit different soils, topography, and farming methods.

2331. U.S. Soil Conservation Service. STANDARD AND SPECIFICATIONS FOR CONSERVATION PRACTICES, ENGINEERING, OHIO. Columbus, Ohio, 62 pp. 1963. A54 So33S

A report was given of the Soil Conservation Service standards and specifications for the engineering of conservation practices for Ohio. The following practices were discussed: Bedding; dikes and levees; diversion; field drainage ditches; main drainage ditches, ponds, grassed waterways or outlets; sprinkler irrigation systems; land smoothing; spring development; terraces; and tile drains.

2332. Uppal, H. L., and Sehgal, S. R. HYDRODYNAMICAL DETERMINATION OF A SUBSOIL WATER-TABLE PROFILE AS AFFECTED BY RAINFALL AND ITS SENSITIVITY TO RAINFALL AND IRRIGATION. Internatl. Comn. Irrig. and Drain. Annu. B. 1961: 29-36. map. 1961. 55.9 In8A

A report was given on the hydrodynamical determination of a subsoil water-table profile as affected by rainfall and irrigation in India.

2333. Uppal, H. L., Singh, G., and Dhand, A. D. EFFECT OF RELEASE PIPES IN THE BED OF SURFACE DRAINS IN HEAVY SOILS ON WITHDRAWAL OF GROUND WATER. Irrig. and Power. 21(3): 419-426. July 1964. 55.9 In222C

A report was given on the use of release pipes to lower the water table in India where a heavy clay layer prevents surface drainage.

2334. Urman, I. PROSPECTS FOR USING VERTICAL DRAINAGE IN THE COTTON GROWING DISTRICTS. (Rus) Khlopkovodstvo. 8(1): 46-48. Jan. 1958. 72.8 K522

2335. Uttar Pradesh Irrigation Research Institute. STEADY STATE SATURATION LINE OF SEEPAGE FROM AN UNLINED CANAL—ITS VARIATION WITH DEPTH OF WATER TABLE AND THE IMPERVIOUS STRATUM, AND ASSESSMENT OF THE WATERLOGGING CONDITIONS THEREOF. Internatl. Comn. Irrig. and Drain. Annu. B. 1964: 42-51. 1964. 55.9 In8A

A report was given on how the top seepage line or the steady state saturation line from an unlined canal varies with varying depth of water table and the impervious stratum in India.

2336. Vallentine, H. R. CHARACTERISTICS OF THE BACKWATER CURVE. J. Hydraul. Div., ASCE 90(HY 4): 39-49. 1964. 290.9 Am3Ps

The profiles of over forty M1 curves in rectangular channels were examined. The ranges of variables covered were: n, from 0.012 to 0.050; breadth-to-depth ratio, 2, 10, and infinity; and bed slope, 10^{-3} to 10^{-6}. The effects of variation of n and So (channel bed gradient) on the profile form were examined. Nondimensional plots of profiles for given channel geometries were found to rank according to normal flow Froude numbers (F_o). The maximum surface displacement and the profile length, expressed in nondomensional form, were found to be functions of F_o.

2337. Van Everdingen, R. O. DISTORTION OF GROUNDWATER FLOW-PATTERNS IN SECTIONS WITH EXAGGERATED VERTICAL SCALE. J. Hydrol. 2(1): 11-14. 1964. 292.8 J82

A report was given on the distortion of ground water flow patterns in sections with exaggerated vertical scale. It was recommended that the true scale be used where possible.

2338. Van Schaik, J. C., and Milne, R. A. RECLAMATION OF A SALINE-SODIC SOIL WITH SHALLOW TILE DRAINAGE. Canad. J. Soil Sci. 42(1): 43-48. Ref. Feb. 1962. 56.8 C162

Leaching studies in Canada showed that shallow glacial soils that have become saline-sodic can be reclaimed with tile drains at a depth of 30 inches with a 30-foot spacing. Only after the application of 71 inches of water was the saline-sodic soil sufficiently reclaimed to allow normal growth.

35, 37. Oct. 1963. 24 So842

A report was given on the design and use of contour banks (terraces) in South Africa.

2340. van Schilfgaarde, J. APPROXIMATE SOLUTIONS TO DRAINAGE FLOW PROBLEMS. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 79-113. 1957. 4 Am392

Under the chapter on Theory of Land Drainage a number of approximate solutions of drainage problems were presented. It was shown how these solutions could be successfully applied and also what restrictions must be imposed as a result of the approximations underlying them. Steady state problems were discussed in one section and non-steady-state problems in another.

2341. van Schilfgaarde, J. DESIGN OF TILE DRAINAGE FOR FALLING WATER TABLES. J. Irrig. and Drain. Div., ASCE 89(IR 2): 1-11. June 1963. 290.9 Am3Ps

An equation was derived and presented for the spacing of tile drains in terms of the rate of water table drop, the depth of an impervious layer below the drains, the hydraulic conductivity of the soil, and an assumed constant drainable pore space. The solution is based on the Dupuit-Forchheimer assumptions.

2342. van Schilfgaarde, J. DESIGN OF TILE DRAINAGE FOR FALLING WATER TABLES. Amer. Soc. Civil Engin. Trans. 129: 815-817. 1964. 290.9 Am3

A digest was given of an article, discussion, and closure of a study on the design of tile drainage for falling water tables. The original article was published in the J. Irrig. and Drain. Div., ASCE 89(IR 3): 1-12, June 1963. References to the discussions and closure were given.

2343. van Schilfgaarde, J., Kirkham, D., and Frevert, R. K. PHYSICAL AND MATHEMATICAL THEORIES OF TILE AND DITCH DRAINAGE AND THEIR USEFULNESS IN DESIGN. Iowa Agr. Expt. Sta. Res. B. 436: 667-706. Ref. Feb. 1956. 100 Io9

Various approaches to a rational theory of drainage problems were analyzed and their usefulness in design were reported.

2344. van Schilfgaarde, J., and Williamson, R. E. GROWTH CHAMBER FOR EVALUATING EXCESS SOIL MOISTURE CONDITIONS FOR DRAINAGE DESIGN. Trans. ASAE 4(1): 108-111, 114. 1961. 290.9 Am32T

A growth chamber was described that was used for evaluating excess soil moisture conditions for drainage design. Experimental observations using the growth chamber were reported.

2345. Varuntsian, E. S. THE PROBLEMS OF PLANNING AND CONSTRUCTION OF A COLLECTION-DRAINAGE SYSTEM ON SALINE SOILS. (Rus) Gidrotekh. i Melior. 7(8): 47-54. Aug. 1956. 290.8 G362

2346. Viets, F. G., Jr., and Muckel, D. C. RECLAMATION OF TIDAL SOILS. Internatl. Comn. Irrig. and Drain., Madrid, Spain. 4(2): 11.1-11.16. 1960. 55.9 C7652

Reclamation of sediments from sea or brackish water involves a very careful evaluation of the engineering factors involved in water control and drainage. An understanding of the problems that may arise in the removal of salts, exchangeable sodium, and potential acidity so that the soil can be productive, is needed.

Levees are usually required to prevent inundation during high tides. Main and lateral drain ditches are required for the removal of excess surface and subsoil water, and outlets, either gravity or pumping plants, are required for the disposal of excess water. Design factors must be based on site conditions such as amount and distribution of precipitation, surface runoff, topography, soil characteristics, tidal fluctuations, and degree of protection warranted.

Water control is important in the design of the drain system. Drainage alone does not guarantee maximum crop yields. The system should be designed and operated whereby the water-tabel depth can be maintained at proper levels for the particular soil and crop to be grown, taking into consideration the changes which occur in the soil after reclamation or drainage.

2347. Vimoke, B. S. USE OF AN ELECTRICAL RESISTANCE NETWORK IN SOLVING PROBLEMS OF STEADY STATE FLOW OF WATER IN SOIL. Diss. Abs. 22(11): 3956. May 1962. 241.8 M58

An abstract was given on an experiment using an electrical resistance network to solve problems of steady state flow of water in soil in Ohio.

2348. Vimoke, B. S., and Taylor, G. S. APPROXIMATE EQUATIONS FOR FLUID FLOW INTO BURIED DRAINS. Soil Sci. Soc. Amer. Proc. 24(5): 418-419. Sept./Oct. 1960. 56.9 So3

A note was given for approximate equations for fluid flow into buried drains.

2349. Vimoke, B. S., Tyra, T. D., Thiel, T. J., and Taylor, G. S. IMPROVEMENTS IN CONSTRUCTION AND USE OF RESISTANCE NETWORKS FOR STUDYING DRAINAGE PROBLEMS. Soil Sci. Soc. Amer. Proc. 26(2): 203-207. Mar./Apr. 1962. 56.9 So3

An improved type of resistance network analog was described that can be used for studying drainage problems.

2350. Visser, W. C. SIZE AND SHAPE OF SUB-DIVISIONS IN DRAINAGE AREAS. Cong. Irrig. and Drain. Trans. 4(3): 11.507-11.512. 1960. 55.9 C7652

A report was given on the size and shape of sub-divisions in drainage areas in the Netherlands for the design of drainage systems.

2351. Visser, W. C., and Bloemen, G. W. THE MOISTURE FLOW TECHNIQUE FOR DETERMINING THE WATER-BALANCE. In International Association of Scientific Hydrology. SYMPOSIUM OF HANNOVERSCH-MUNDEN. Gentbrugge, 1: 128-139. 1959. 292.9 As7C

A report was given on the use of the water flow technique for determining the water balance in the Netherlands.

2352. Vlugter, H. SEDIMENT TRANSPORTATION BY RUNNING WATER AND THE DESIGN OF STABLE CHANNELS IN ALLUVIAL SOIL. Cong. Irrig. and Drain. Trans. 4(5): 14.397-14.406. 1960. 55.9 C7652

A study was reported on sediment transportation by running water to help in the design of stable channels for drainage and irrigation canals in the Netherlands.

2353. Volobuev, V. R. ON WATERING STANDARDS FOR THE RECLAMATION OF SALINE SOILS. (Rus) Gidrotekh. i Melior. 1959(12): 18-24. Ref. Dec. 1959. 290.8 G362

2354. Vyzgo, M. S. TECHNICAL-ECONOMIC SCHEMES OF HYDRAULIC COMPUTATION OF CANALS AND STRUCTURES. (Rus) In Uzbekistan. SOVET PO IZUCHENIIU PROIZVODITEL'NYKH SIL. GOLODNAIA STEP. Tashkent, pp. 217-226. Ref. 1957. 54 Uz1

2355. Wakefield, J. W., Schiesswohl, D. P., Ferguson, G. E., and Johnson, L. PANEL DISCUSSION: SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT. Soil and Crop Sci. Soc. Fla. Proc. 21: 287-302. maps. Ref. 1961, pub. 1962. 56.9 So32

A panel discussion was given of factors involved in planning for the management of water control in the Southeast Florida Water Management District.

2356. Walker, P., and Lillard, J. H. LAND FORMING RESEARCH IN VIRGINIA. Trans. ASAE 4(1): 138-139. 1961. 290.9 Am32T

Research results were reported on land forming for surface drainage in Virginia. Engineering design factors and grading costs for land forming for field experiments in the Coastal Plain and Piedmont River bottoms were given.

2357. Wang, F. C., Hassan, N. A., and Franzini, J. B. A METHOD OF ANALYZING UNSTEADY, UNSATURATED FLOW IN SOILS. J. Geophysical Res. 69(12): 2569-2577. Ref. June 15, 1964. 470 J823

A numerical method of analyzing unsteady, unsaturated flow in soils was presented. If the hydraulic and capillary characteristics of the soil and the initial moisture condition were known, the method permited prediction of the future disposition of soil moisture as a function of time and location. The technique was particularly adaptable to problems of infiltration, drainage, and upward flow induced by evaporation. Darcy's law was combined with the continuity principle, and a solution was achieved through a step-by-step numerical procedure. Soil moisture profiles were obtained from a digital computer.

2358. Wang, F. F. C. C. AN APPROACH TO THE SOLUTION OF UNSTEADY UNSATURATED FLOW PROBLEMS IN SOILS. Diss. Abs. 24(3): 1114. Sept. 1963. 241.8 M58

An analytical approach was presented to the solution of unsteady unsaturated flow problems in California.

2359. Wartena, L. THE SEEPAGE OF A RIVER INTO A VALLEY FILLED WITH TWO LAYERS OF DIFFERENT PERMEABILITIES. Netherlands J. Agr. Sci. 9(2): 118-121. May 1961. 12 N3892

Formulas were developed for the seepage of a river into a valley filled with two layers of soil material of different permeabilities in the Netherlands.

2360. Wasley, R. J. UNIFORM FLOW IN A SHALLOW, TRIANGULAR OPEN CHANNEL. Amer. Soc. Civil Engin. Trans. 128(1): 634-654. 1963. 290.9 Am3

A smooth, shallow, triangular open channel was investigated to determine the characteristics of uniform flow in an idealized highway gutter. Depths, velocity contours, and transverse velocity distributions were presented for various slope configurations and flow rates.

With discussion by Messrs. Edward J. Low; and Richard J. Wasley. pp. 655-656.

2361. Watanabe, K. ON THE STEADY SEEPAGE INTO DRAIN TUBES IN SOIL OVERLYING AN IMPERVIOUS LAYER. I. STREAM LINES WHICH INDUCED BY THE DIFFERENT QUANTITIES OF WATER IN DRAIN TUBES DIFFERED EACH OTHER. (Ja) Saga U. Agr. B. 11: 169-180. July 1960. 107.6 Sa13 English summary.

A study in Japan was reported on the seepage into two drain tile lines over an impervious layer. Streamlines obtained in a sand tank model and electric model test were described and illustrated.

2362. Watson, K. K. THE APPLICATION OF DRAINAGE THEORY TO THE RADIUS AND SPACING OF DRAIN CHANNELS. J. Agr. Engin. Res. 4(3): 222-228. 1959. 58.8 J82

The basic concepts involved in an understanding of the principles of the flow of water to a drain channel system were discussed with particular reference to the relationship existing between the variables.

2363. Watson, K. K. A NOTE ON THE FIELD USE OF A THEORETICALLY DERIVED INFILTRATION EQUATION. J. Geophysical Res. 64(10): 1611-1615. Ref. Oct. 1959. 470 J823

The use of equations of the diffusion type as a means of solving certain flow problems in porous media has recently led to a convenient analytical solution for the infiltration of water into an homogenous soil of uniform initial moisture content. From the general solution a simplified infiltration equation was obtained. This simplified equation was tested against field infiltration curves in order to investigate its possible use for the expression of these field curves with a great degree of accuracy.

2364. Watters, G. Z., and Street, R. L. TWO-DIMENSIONAL FLOW OVER SILLS IN OPEN CHANNELS. J. Hydraul. Div., ASCE 90(HY 4): 107-140. 1964. 290.9 Am3Ps

An ideal fluid was used to approximate the two-dimensional flow of a real fluid over sills in an open channel. The computation of the location of the free surface, the velocity, and the pressure at any point in the flow was made possible by a general theory that used complex function theory and conformal mapping. The general theory was derived by considering flow over a simple, vertical step in an open channel. The theory was expanded to include flow over polygonal sills, flow over smooth sills, and through smooth transitions. Numerical examples were given for particular flow configurations.

2365. Weaver, H. A., and Speir, W. H. APPLYING BASIC SOIL WATER DATA TO WATER CONTROL PROBLEMS IN EVERGLADES PEATY MUCK. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-40, 15 pp. Nov. 1960. A56.9 R31

Basic soil and water data for Everglades peaty muck were examined for their adaptability to solutions of water control problems.

Underdrain spacings at a 30-inch depth should not exceed about 40 feet, and ditches penetrating to the impermeable layer should not exceed 60 feet where either system must be depended upon to lower water tables to safe depth within 48 hours after profile saturation.

2366. Webster, M. J., and Metcalf, L. R. FRICTION FACTORS IN CORRUGATED METAL PIPE. J. Hydraul. Div., ASCE 85(HY 9): 35-74. Sept. 1959. 290.9 Am3Ps

A study was made to determine friction coefficients for flow in large corrugated metal pipe by measurement of head losses in pipes 3, 5, and 7 feet in diameter. Velocity distribtuion for several discharges in each test pipe were made so that the results could be generalized to show the relationship between friction coefficients and absolute roughness. Data taken during the study were presented together with recommended values of friction and roughness coefficients.

2367. Wertz, G. A CONTRIBUTION TO THE SUBSIDENCE OF SWAMPS IN THE COURSE OF TIME. (Ge) Z. f. Landeskult. 4(3/4): 251-252. 1963. 282.9 Z3
English summary.

An improved formula was presented to help determine the subsidence of swamps as a function of time in East Germany.

2368. Wesseling, J. THE RELATION BETWEEN RAINFALL, DRAIN DISCHARGE AND DEPTH OF THE WATER TABLE IN TILE-DRAINED LAND. Netherlands J. Agr. Sci. 6(1): 47-60. Ref. Feb. 1958. 12 N3892

Research on tile drained land in the Netherlands was given where the relation between rainfall, drain discharge, and depth of water table in the tile-drained land were studied.

Descriptions and illustrations of a recording drain gauge and a ground water level recorder were given.

2369. Wesseling, J. PRINCIPLES OF THE UNSATURATED FLOW AND THEIR APPLICATION TO THE PENETRATION OF MOISTURE INTO THE SOIL. Inst. for Land and Water Mangt. Res., Wageningen Tech. B. 23: 1-23. 1961 282.9 W12T

A report was given on the principles of the unsaturated flow and their application to the penetration of moisture into the soil.

2370. Wesseling, J. REPORT TO THE GOVERNMENT OF ISRAEL ON FIELD DRAINAGE RESEARCH. Food and Agr. Organ. United Nations.Expanded Tech. Asst. Program FAO Rpt. 1752, 23 pp. 1963. 281.9 F733E

A report was given on present and future field drainage research in Israel.

2371. Wesseling, J. A COMPARISON OF THE STEADY STATE DRAIN SPACING FORMULAS OF HOOGHOUDT AND KIRKHAM IN CONNECTION WITH DESIGN PRACTICE. J. Hydrol. 2(1): 25-32. Ref. 1964. 292.8 J82

It was shown that the steady state drainage equations proposed by Hooghoudt (1940) and Kirkham (1958) gave results which differed less than 5 percent in cases where the flow in the layer above the drains is neglected. When a water table occurs higher midway between the drains, the Hooghoudt formula was preferred.

2372. Wesseling, J. A COMPARISON OF THE STEADY STATE DRAIN SPACING FORMULAS OF HOOGHOUDT AND KIRKHAM IN CONNECTION WITH DESIGN PRACTICE. Inst. for Land and Water Mangt. Res., Wageningen Tech. B. 34: 25-32. 1964. 282.9 W12T

A discussion was given of the comparison of the steady state drain spacing formulas of Hooghoudt and Kirkham in connection with design practice.

2373. Wesseling, J. THE EFFECT OF USING CONTINUALLY SUBMERGED DRAINS ON DRAIN SPACINGS. Inst. for Land and Water Mangt. Res., Wageningen Tech. B. 35: 33-43. 1964. 282.9 W12T

A study was reported of the effect of using continually submerged drains on drain spacings.

2374. Wesseling, J. THE EFFECT OF USING CONTINUALLY SUBMERGED DRAINS ON DRAIN SPACINGS. J. Hydrol. 2(1): 33-43. 1964. 292.8 J82

The solution of the flow problem of Kirkham was calculated for submerged drains. Examples showed that under some favorable conditions a considerable increase of drain spacings can be obtained by using deep, submerged drains of plastic pipe.

2375. Wesseling, J. DIAGRAMS FOR THE DETERMINATION OF THE DIAMETER OF TILE AND PLASTIC DRAINAGE SYSTEMS. (Du) Landbk. Tijdschr. 76(12): 455-464. July 1964. 105.2 Or3
English summary.

Diagrams were given to help determine the diameter of tile and plastic drainage systems needed in the Netherlands.

2376. Wesseling, J., and Leven, J. A. Van't. DRAINAGE OF THE POLDER DISTRICTS IN THE NETHERLANDS. Cong. Irrig. and Drain. Trans. 4(3): 11.513-11.527. Ref. 1960. 55.9 C7652

A report was given on the planning of drainage design on the polders in the Netherlands. The whole system of drainage and pumping must be in accordance with each other.

2377. Wesseling, J., and Wijk, W. R. van. SOIL PHYSICAL CONDITIONS IN RELATION TO DRAIN DEPTH. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 461-504. 1957. 4 Am392

A report was given on the soil physical condition in relation to drain depth. The following factors were discussed: (1) Aeration of the soil; (2) water requirements of crops; (3) examples of calculation of maximum depth of drainage; and (4) miscellaneous physical aspects of drainage.

2378. Whelchel, H. C. INDIAN RIVER CITRUS COMES OF AGE. Fla. State Hort. Soc. Proc. 76: 51-53. 1963. 81 F66

The drainage requirement of land for citrus production in the Indian River Area of Florida was discussed along with other problems of the area.

2379. Wilcox, J. C. RATE OF SOIL DRAINAGE FOLLOWING AN IRRIGATION. I. NATURE OF SOIL DRAINAGE CURVES. Canad. J. Soil Sci. 39(2): 107-119. Ref. Aug. 1959. 56.8 C162

A report was given on the rate of soil drainage following irrigation in Canada. Curves of moisture loss cumulative with time were given.

2380. Wilcox, L. V., and Resch, W. F. SALT BALANCE AND LEACHING REQUIREMENT IN IRRIGATED LANDS. U.S. Dept. Agr., Agr. Res. Serv. Tech. B. 1290, 23 pp. 1963. 1 Ag84T

The two criteria, salt balance (SB) and leaching requirement (LR), were compared as to their usefulness in describing and evaluating salinity conditions on an irrigation project.

The terms were defined and the interrelationship of the two was shown. Three methods for the calculation of salt balance are: (1) Output of salt minus input of salt, where observed values are used; (2) salt burden of the stream at the gaging station below the project minus the salt burden at the gaging station above the project; and (3) calculated output of salts minus the measured input of salts. Method 3 provides, in addition to salt-balance data, calculated values for both the volume and salt concentration of the drainage-return water. The accuracy of the three methods of calculation were compared by the use of data from irrigation projects in the Rio Grande Basin. Method 1 was of doubtful accuracy because of the near impossibility of obtaining satisfactory data for the drainage return. Methods 2 and 3 yielded very similar results for salt balance, the accuracy of which was limited only by the accuracy of the data.

2381. Willet, J. R. PRINCIPLES OF DRAINAGE. (Du) Nederland. Heidemaatsch. Tijdschr. 73(7/8): 218-222. July/Aug. 1962. 12 N282

2382. Willet, J. R. "UNRIPE" SANDY SOILS AND THEIR DRAINAGE. (Du) Nederland. Heidemaatsch. Tijdschr. 73(12): 403-408. Dec. 1962. 12 N282

2383. Williams, D. A. ENGINEERING MEASURES IN FARM AND WATERSHED CONSERVATION. Soil Conserv. 26(12): 267. July 1961. 1.6 So3S

A discussion was given on engineering measures in farm and watershed conservation. Statistics were given on completed conservation measures installed by soil conservation district cooperators.

2384. Wimberly, J. E. DESIGNING A FURROW IRRIGATION SYSTEM FOR SUGAR CANE. (Condensed.) Agr. Engin. 45(3): 138-139. Mar. 1964. 58.8 Ag83

A report was given on the designing of a drainage system for a furrow irrigation system for sugarcane.

2385. Wind, G. P., and Bos, H. LEVELING REQUIREMENTS OF ARABLE LAND. (Du) Nederland. Heidemaatsch. Tijdschr. 75(1): 41-50. Jan. 1964. 12 N282

2386. Wit, C. T. De. WATER TRANSPORT IN DRAINS AS INFLUENCED BY TILE ALIGNMENT. Netherlands J. Agr. Sci. 5(3): 149-156. Aug. 1957. 12 N3892

Irregularities at the tile drain were defined and their effect of the velocity of water in the drain was calculated.

2387. Wit, C. T. De, and Wartena, L. THE INFLUENCE OF IRREGULARITY OF THE JOINTS ON THE MAXIMUM WATER TRANSPORT IN DRAINAGE PIPES. (Du) Nederland. Heidemaatsch. Tijdschr. 68(5): 111-114. May 1957. 12 N282

2388. Witherington, C. G., Rogers, A. J., Beidler, E. J., and Salmela, J. A STUDY OF DIKING METHODS IN FLORIDA SALT MARSHES. Fla. Anti-Mosquito Assoc. Rpt. Annu. Mtg. 28: 90-93. 1957. 420 F663

A report was given on a study of diking methods used for impounding water in salt marshes to control salt-marsh Aedes. The principal objective was to determine the most efficient location of ditches in relation to dikes.

2389. Wohlfarth, E. DRAINAGE OF STAGNO-GLEY SOILS. (Ge) Allg. Forstz. 16(12): 220-221. map. Mar. 25, 1961. 99.8 AL52

2390. Woo, D., and Brater, E. F. LAMINAR FLOW IN ROUGH RECTANGULAR CHANNELS. J. Geophysical Res. 66: 4207-4217. 1961. 470 J823

The results of an investigation of open channel flow in the laminar and transition ranges were presented. This type of flow is encountered during runoff from rainfall. Values of the friction factor were determined for two roughnesses and for 11 slopes varying from 0.001 to 0.060. It was found that for laminar flow the values departed significantly from the theoretical ones derived for smooth surfaced and that for very rough surfaces the variations depended on the slope. The results for both the laminar and transition ranges were presented graphically to permit comparison with theoretical values and with results obtained by other investigators. These data should prove useful in studies of overland flow and particularly for investigations of soil erosion.

2391. Woo, D.-C., and Brater, E. F. SPATIALLY VARIED FLOW FROM CONTROLLED RAINFALL. Amer. Soc. Civil Engin. Trans. 129: 319-321. 1964. 290.9 Am3

A digest was given of an article discussion, and the closure on the research conducted to develop information regarding the mechanics of spatially variable flow produced by rainfall. The original article was published in J. Hydraul. Div., ASCE 88(HY 6): 31-56, Nov. 1962. References to the discussions and closure were listed.

2392. Worley, L. D. PLANNING TERRACE SYSTEMS TO FACILITATE FARM MACHINERY OPERATION. Trans. ASAE 3(1): 68-70, 72. 1960. 290.9 Am32T

A report was given on a system of parallel terraces plus waterways to facilitate farm machinery operation.

2393. Worstell, R. V., and Luthin, J. N. A RESISTANCE NETWORK ANALOG FOR STUDYING SEEPAGE PROBLEMS. Soil Sci. 88(5): 267-269. Nov. 1959. 56.8 So3

A report was given on a resistance network analog for studying drainage problems in layered soils or in soils with anisotropic permeability.

2394. Wright, K. R. MODEL APPROACH TO A GROUNDWATER PROBLEM. J. Irrig. and Drain. Div., ASCE Proc. 84(IR 4, 1862), 9 pp. Dec. 1958. 290.9 Am3Ps

A report was given on the use of an electric analog plotter model and a hydraulic model to investigate a ground water problem located in an unconfined aquifer.

2395. Wright, K. R. USE OF MODELS TO STUDY GROUND-WATER PROBLEMS. Amer. Soc. Civil Engin. Trans. 125: 133-140. 1960. 290.9 Am3

When adverse field conditions preclude a direct field investigation of a ground-water problem, models can often be utilized to advantage in the determination of directions of flow, velocities, location of hydraulic divides, and in forecasting conditions that may occur in the future. Two types of models, electric analog plotter and hydraulic, were found satisfactory for the investigation of a ground-water problem located in an unconfined aquifer.

2396. Yajima, T. ON THE EFFECT OF RAIN-FALL DISTRIBUTION ON LAND RECLAMATION WORKS. (Ja) Nogyodoboku-Kenkyu. 26(6): 317-321. Feb. 1959. 290.8 N68

2397. Yakovlev, B. I. DRAINAGE DISCHARGE FROM LOAMY SOILS FED BY ATMOSPHERIC AND GROUND WATER. (Rus) Belorusskaya Sel'skokhoz. Akad. Trudy. 35: 74-94. 1961. 106 B415

2398. Yamaguchi, E., and Nagaishi, Y. AMOUNTS OF PERCOLATION WATER OF PADDY FIELD ON POLDERING LAND. III. (Ja) Kyushu Agr. Res. 20: 130-132. Mar. 1958. 107.6 K996

2399. Yamazaki, F., Yawata, T., Takenaka, H., and Tabuchi, T. ON THE EFFECT OF CRACKS IN SUB-SOIL, UPON DRAINING OF THE HEAVY CLAY SOIL IN KOMUKAI, HOKKAIDO. (Ja) Nogyodoboku-Kenkyu. 30(8): 427-434. Apr. 1963. 290.8 N68
English summary.

A report was given on the effects of cracks in the subsoil on drainage of heavy clay soils with tile drainage in Japan.

2400. Yokota, R., Dokoshi, J., and Maeda, T. DEVELOPMENT OF THE SAROBETSU WASTE LAND AND ITS INFLUENCE ON METEOROLOGICAL CONDITIONS. II. THE INFLUENCE ON METEOROLOGICAL CONDITIONS OF DRAINAGE CANALS. (Ja) Soc. Agr. Met. Japan J. Agr. Met. 19(2): 22-24. map. Nov. 1963. 340.9 So1

2401. Youngs, E. G. WATER-TABLE HEIGHTS IN A DRAINED HOMOGENEOUS SOIL OVERLYING AN INFINITELY PERMEABLE LAYER. J. Soil Sci. 10(1): 101-104. Ref. Mar. 1959. 56.8 J823

Electric-analog experiments were described which gave solutions to the particular case of a homogeneous soil, drained by a uniform system of ideal drain tubes and overlying an infinitely permeable layer, for different ratios of rainfall intensity to hydraulic conductivity and for various depths of the permeable layer below the drain level.

2402. Youngs, E. G. THE DRAINAGE OF LIQUIDS FROM POROUS MATERIALS. J. Geophysical Res. 65(12): 4025-4030. Ref. Dec. 1960. 470 J823

An equation was derived to describe the yield of liquid at a given time from a freely draining column of initially saturated porous material in a gravitational field by using a capillary tube mode. The equation was supported by experimental evidence.

2403. Youngs, E. G., and Towner, G. D. A STUDY OF SOME THREE-DIMENSIONAL FIELD-DRAINAGE PROBLEMS. II. MESH SYSTEMS WITH MAJORS AND MINORS AT DIFFERENT LEVELS. Soil Sci. 95: 369-375. 1963. 56.8 So3

The Dupuit-Forchheimer analysis was used to obtain approximate relationships between the water-table height, rainfall rate, soil hydraulic conductivity, and the geometry of rectangular-mesh drainage systems with majors and minors at different levels for the case of the lower drain on an impermeable floor. The results were confirmed by hydraulic model experiments.

2404. Yunevich, D. P., and Chernenok, V. Y. DEEP DRAINAGE OF FLOOR-PLAIN PEAT BOGS BY SUB-DRAINAGE. (Rus) Gidrotekh. i Melior. 7: 47-54. July 1964. 290.8 G362

2405. Zaidel'man, F. R. DEEP DRAINAGE OF PEATY LOWLANDS. (Rus) Gidrotekh. i Melior. 1960(11): 25-31. Nov. 1960. 290.8 G362

2406. Zaitsev, V. B. SOME PROBLEMS IN DESIGNING RICE IRRIGATION SYSTEMS. (Rus) Gidrotekh. i Melior. 1961(9): 33-41. Ref. Sept. 1961. 290.8 G362

2407. Zamarin, E. A. ASSEMBLED HYDROTECHNICAL CONSTRUCTIONS. (Rus) Vsesoiuzn. Akad. Sel'-skokhoz. Nauk im. V. I. Lenina. Dok. 20(6): 42-44. 1955. 20 Ak1

2408. Zanker, K. A NEW METHOD FOR THE DETERMINATION OF APPROPRIATE DEPTHS AND SPACINGS OF TILE DRAINS WITH REGARD TO HYDRAULIC CONDUCTIVITY OF SOIL AND TO DEPTH OF AN IMPERMEABLE LAYER. Cong. Irrig. and Drain. Trans. 4(3): 11.393-11.416. Ref. 1960. 55.9 C7652

Numerous series of experiments were reported from Germany of the correlations between permeability of the soil, drainage effects of tile drainage systems, and the geometric proportions of the extent of current. The latter includes: Drain distance; drain depth, diameter of drain pipe; and depth of an impermeable substratum.

2409. Zanker, K. POSITION OF GROUND-WATER TABLE AND POTENTIAL OF VELOCITY. Cong. Irrig. and Drain. Trans. 5(5): R.17.199-R.17.211. 1963. 55.9 C7652

A report was given on the measurement of velocity and the position of ground water table for drainage design for drain spacings and drain depths for pipe drainage.

2410. Zaslavsky, D. SATURATED AND UNSATURATED FLOW EQUATION IN AN UNSTABLE POROUS MEDIUM. Soil Sci. 98(5): 317-321. Nov. 1964. 56.8 So3

A report was given on the use of a saturated and unsaturated flow equation in an unstable porous medium.

2411. Zdobnov, E. I. AMOUNT OF LEACHING RATE BASED ON OPERATION OF MUGAN BURIED DRAINAGE. (Rus) Gidrotekh. i Melior. 3: 47-51. Mar. 1964. 290.8 G362

2412. Zdobnov, E. I. ON THE QUANTITY OF LEACHING NORMS AS EXEMPLIFIED BY SUB-DRAINAGE IN THE MUGAN AREA. (Rus) Akad. Nauk Azerb. SSR. Dok. 20(5): 47-51. 1964. 511 Ak147D

2413. Zee, C.-H., Peterson, D. F., Jr., and Bock, R. O. FLOW INTO A WELL BY ELECTRIC AND MEMBRANE ANALOGY. Amer. Soc. Civil Engin. Trans. 122: 1088-1105. 1957. 290.9 Am3

A study of radially symmetrical, unconfined flow to a well was presented. The discharge of such a system was related, using dimensional considerations, to the permeability of the aquifer and the geometric characteristics of the influence region. In order to study the problem, the electrical analogy for hydraulic flow was combined with the membrane analogy for a free surface. The experimental results obtained were combined with observations of other investigators to develop empirical relationships between the flow and the geometric variables.

With discussion by Messrs. Robert E. Glover; Vaughn E. Hansen; James N. Luthin; Chia-Shun Yih; and Chong-Hung Zee, Dean F. Peterson; and Robert O. Bock. pp. 1106-1112.

2414. Zeeuw, J. W. De. SOME ASPECTS OF THE DESIGN OF DRAINAGE SYSTEMS IN LOW-LYING AREAS. Cong. Irrig. and Drain. Trans. 4(2): 11.251-11.280. maps. 1960. 55.9 C7652

A report was given on the design of drainage systems in the low-lying areas of the Netherlands.

2415. Zeeuw, J. W. De, and Hellinga, F. PRECIPITATION AND DISCHARGE. (Du) Landbk. Tijdschr. 70(5): 405-422. Ref. May 1958. 105.2 Or3
English summary.

Design discharge for the dimensions of drains, watercourses culverts, pumping stations, etc. were given for the Netherlands based on design discharge and design storm.

2416. Zheleznyakov, G. V., and Danilevich, B. B. CALCULATION OF RUNOFF MODULUS OF SPRING FLOOD PERIOD AND OF PRE-PLANTING PERIOD WHEN PLANNING DRAINAGE SYSTEM. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 48: 183-194. 1962. 106 P44

2417. Zimmermann. NEW LAND ON OLD SOIL. (Ge) Mitt der Deut. Landwirt.-Gesell. 74(21): 655-657. May 21, 1959. 18 N39

2418. Zubets, V. M. IMPROVING THE UTILIZATION OF DRAINAGE SYSTEMS. (Rus) Gidrotekh. i Melior. 9: 25-29. Sept. 1963. 290.8 G362

2419. Zumberge, J. H. LAND DRAINAGE AND THE WATER TABLE IN SOUTHERN MICHIGAN AND NORTHERN INDIANA. Mich. Acad. Sci. Arts and Let. Papers 42(1): 105-113. 1957. 500 M582

A report was given on the history of land drainage on the regional water table in Calhoun Co. Michigan. The area was then used as a basic for a more general discussion of the problem in southern Michigan and northern Indiana.

2420. Zwerman, P. J., Bauer, A. J., Musgrave, R. B., and Goodman, A. M. DRAINAGE PRACTICES AND PROBLEMS. J. Soil and Water Conserv. 11: 67-72. Ref. Mar. 1956. 56.8 J822

Approximately two million acres or 22 percent of all cropland in New York is so poorly drained that it represents a serious farm problem. The extent of poorly drained land for each of the state's five major soil areas were given. Artifical drainage practices were evaluated for each of the major soil areas in terms of : (1) Kinds of drains used; (2) amount of drain installed; (3) crop adaption to natural soil-drainage classes; and (4) problems that are found in present practices.

SEE ALSO--127, 371, 373, 396, 401, 403, 416, 444, 476, 491, 501, 503, 507, 510, 514, 519, 533, 534, 539, 559, 562, 572, 574, 590, 601, 602, 617, 630, 653, 665, 680, 683, 685, 689, 717, 724, 737, 747, 755, 758, 763, 764, 769, 779, 783, 788, 796, 799, 805, 808-810, 823, 827, 829, 830, 836, 837, 845, 853, 854, 865, 905, 923, 926, 931, 934, 936, 943, 946-949, 968, 975, 980, 1004, 1005, 1012, 1014, 1029, 1030, 1052, 1056, 1063, 1067, 1111, 1115, 1116, 1122, 1141, 1147, 1150, 1151, 1181, 1189, 1190, 1198, 1205, 1211, 1219, 1223, 1224, 1237, 1243, 1249b, 1252-1256, 1262-1264, 1272, 1274, 1276, 1278, 1281-1283, 1286, 1293, 1295, 1302, 1307, 1310, 1313, 1331-1333, 1338, 1340, 1344, 1346, 1351, 1355, 1374, 1375, 1377, 1383, 1387, 1391, 1393, 1397-1401, 1407, 1412, 1413, 1421, 1422, 1424, 1426, 1429, 1430, 1433, 1437, 1440, 1443, 1450, 1451, 1456, 1457, 1461, 1479, 1484, 1487, 1497, 1498, 1500, 1502, 1507, 1510, 1514, 1516-1520, 1524, 1530, 1537, 1540, 1548, 1555, 1557-1560, 1570, 1574, 1579, 1580-1583, 1586, 1589, 1590, 1592-1596, 2434, 2447, 2475, 2492, 2497, 2534, 2537, 2550, 2554, 2603, 2606, 2637-2640, 2642, 2649, 2657, 2658, 2717, 2735, 2737, 2742, 2755, 2756, 2762, 2770, 2773, 2775, 2776, 2795, 2811, 2854, 2855, 2858, 2865, 2886, 2891, 2892, 2896, 2897, 2906, 2909, 2919, 2923, 2924, 2936, 2954, 2959, 2968, 2988, 2998, 3075, 3100, 3113, 3123, 3142, 3157, 3176, 3193, 3209-3212, 3231, 3236, 3262, 3274, 3298, 3302, 3306-3308, 3313, 3316, 3319, 3321, 3330, 3331, 3343, 3344, 3349, 3353, 3354, 3357, 3358, 3367, 3369, 3374, 3381, 3384, 3399, 3405, 3413, 3415, 3422, 3427, 3439, 3447, 3457, 3463, 3468, 3473, 3478, 3485, 3490, 3495, 3515, 3519-3523, 3525-3531, 3534, 3540, 3543, 3546, 3549, 3555, 3556, 3568, 3571, 3577, 3584, 3594, 3603, 3604, 3628, 3646, 3649, 3650, 3670, 3674, 3677, 3698, 3703, 3721, 3734, 2760, 3770-3772, 3784, 3797, 3821, 3834, 3836, 3857, 3862, 3875, 3876, 3886, 3888, 3911, 3918, 3929, 3930, 3935, 3944, 3949, 3955, 3956, 3958, 3960, 3976, 3980, 3981, 3986, 3995, 4002, 4012, 4024, 4030, 4042, 4049, 4061, 4062, 4064, 4066, 4074, 4078, 4080, 4086, 4097, 4107, 4142, 4172, 4188, 4190, 4200, 4222, 4223, 4225, 4269, 4280, 4283, 4287, 4319, 4323, 4324, 4347, 4359, 4369, 4398, 4399, 4405, 4416, 4429, 4446, 4470, 4604, 4605, 4741, 4748, 4766, 4768, 4771, 4828, 4829, 4848, 4861, 4931, 4936, 4954, 4968, 4996, 5018, 5020, 5033, 5035, 5083, 5095.

Effect of Drainage and/or Salinity on Crops, Soils, Trees, Diseases, Microbiology, and Fertilizer Use

2421. Abel, G. H., and MacKenzie, A. J. SALT TOLERANCE OF SOYBEAN VARIETIES (*GLYCINE* *MAX* L. MERRILL) DURING GERMINATION AND LATER GROWTH. Crop Sci. 4(2): 157-161. 1964. 64.8 C883

Six soybean varieties were evaluated for their reactions to salinized soil during germination and later growth.

Seed germination studies at 28° C. ±1° with soil salinities ranging from 3.1 to 13.7 millimhos/cm. showed that salinity decreased percent and rate of emergence. The decreases in rate of emergence of some varieties were greater than those of others. The varietal differences in emergence rate at the lower salinities were not related to the differences in emergence rate at the higher.

Growth was evaluated in the field in soil differing in salinity from 5.0 to 10.2 millimhos/cm. Salinity modified a number of the growth characters of 4 varieties much more than those of 2 varieties considered salt tolerant.

2422. Abichandani, C. T., and Patnaik, S. NITROGEN CHANGES AND FERTILIZER LOSSES IN LOWLAND WATER-LOGGED SOILS. J. Indian Soc. Soil Sci. 6: 87-93. 1958. 56.9 In2

In lowland waterlogged soils incubated at 35° C., ammoniacal nitrogen of soil increased progressively and nitrate nitrogen decreased rapidly and after 3 to 5 days of waterlogging, only traces of nitrate nitrogen remained in the soil. Large nitrogen losses, particularly from surface applied fertilizer, were observed and were attributed to denitrification occurring in the subsurface reducing zone of waterlogged soil. Nitrogen loss was rapid in the first seven days of waterlogging and later decreased considerably.

Nitrogen losses with surface and subsurface applied ammonium sulfate and ammonium nitrate were compared and subsurface application was found superior to surface application in all respects. Recovery of ammoniacal nitrogen with subsurface placed ammonium sulfate was 88 percent and with surface application, it was only 40 percent, after a waterlogging period of 42 days. Ammonium nitrate was found far inferior to ammonium sulfate. Recovery of ammoniacal nitrogen with ammonium nitrate was 44 percent and 24 percent respectively with subsurface and surface application.

Subsurface application of ammonium sulfate fertilizer as compared to surface application was also found to assure higher and deeper distribution of fertilizer in the soil profile and avoided possible losses of nitrogen in the surface drained water in submerged soils.

2423. Agarwala, S. C., Mehrotra, N. K., and Sinha, B. K. INFLUENCE OF EXCHANGEABLE SODIUM ON THE GROWTH AND MINERAL COMPOSITION OF PLANTS. I. PADDY AND BARLEY. J. Indian Soc. Soil Sci. 12(1): 7-24. 1964. 56.9 In2

The effects of ESP on the growth and mineral composition of barley plants grown in soils of sodium carbonate and bicarbonate series, each at nine ESP and of rice plants grown in soils of sodium carbonate, bicarbonate, and sulfate series, each at thirteen ESP were studied. Growth of barley and rice plants was depressed at high ESP on soils of the sodium carbonate and bicarbonate series. In the sodium sulfate series, there was hardly any growth depression in rice.

2424. Agerberg, L. S. SHRINKAGE OF THE BRANNBERG BOG. (Sw) Uppsala. Lantbrhogsk. Och Stat. Lantbrforsok. Stat. Jordbrforsok. Meddel. 77: 1-36. Ref. 1956. 104 Up63
English summary.

A report was given on the shrinkage of the Brannberg Bog in Sweden. There was a surface settling of 2.7 cm. per year during the completion of the main drainage system (1908-22); 2.8 cm. per year for the period 1922-28; 1.6 cm. per year during the period 1928-35; and 1.1 cm. in the years 1935-50. The deepest point in the peat showed a total sinking of 161 cm. from 1902-50.

2425. Agerberg, L. S. STUDIES ON CHANGES IN THE LEVEL OF PEAT SOIL SURFACE. (Sw) Grundforbattring. 14(3): 141-176. maps. Ref. 1961. 54.8 G92
English summary.

Studies were reported in Sweden on the change in the level of peat soil surface from drainage by settling, tillage, crop production, and surface sinking (subsidence).

2426. Agerberg, L. S. SUBSIDENCE OF MARSHES. (Sw) Beten-Vallar-Mossar. 13(5/6): 78-81. map. June/July 1961. 11 B46

2427. Aglibut, A. P. SOME PROBLEMS OF IRRIGATION IN RICE CULTURE. Soil Sci. Soc. Philippines J. 10(2/3): 52-60. 1958. 56.9 So35

A report was given on the problems connected with the irrigation of rice in the Philippines. There was a tendency to obtain better yield of rough rice from intermittent than from continuous submergence irrigation. This required good drainage conditions. On the poorly drained fields it was very important to use varieties that were resistant to diseases common to such waterlogged soils.

2428. Ahmad, N. THE EFFECT OF EVOLUTION OF GASES AND REDUCING CONDITIONS IN A SUBMERGED SOIL ON ITS SUBSEQUENT PHYSICAL STATUS. Trop. Agr. [St. Augustine] 40(3): 205-209. July 1963. 26 T754

A report was given on the evolution of gases and reducing conditions in a submerged soil on its subsequent physical status in the West Indies.

2429. Alampi, P. AGRICULTURE'S INTEREST IN DRAINAGE. N.J. Dept. Health Pub. Health News. 41(12): 426-427, 429. Dec. 1960. 449.7 N46P

A report was given on the effect of drainage on agriculture in New Jersey.

2430. Alban, K., Shambaugh, G., Schwab, G. O., and Wilson, E. WATER QUALITY AS AFFECTED BY AGRICULTURAL CHEMICALS AND OTHER CONTAMINANTS—PANEL DISCUSSION. Ohio Agr. Expt. Sta. Spec. Rpt. Ser. 2: 7-14. 1963. 100 Oh3 Spe

A report was given on a panel discussion of the effect of agricultural chemicals and other contaminants on water quality.

2431. Albrecht, Z. LOCUST FAUNA (SALTATORIA) OF ESTONIAN MOORS AND CHANGES CAUSED BY DRAINAGE. (Rus) Ent. Kogumik. 1: 37-47. 1959. 421 En896
German summary.

2432. Allison, R. V. THE INFLUENCE OF DRAINAGE AND CULTIVATION ON SUBSIDENCE OF ORGANIC SOILS UNDER CONDITIONS OF EVERGLADES RECLAMATION. Soil and Crop Sci. Soc. Fla. Proc. 16: 21-31. 1956. 56.9 So32

A report was given on the influence of drainage and cultivation on subsidence of organic soils in Florida.

2433. Amanbekov, K. T. CHARACTERISTICS OF SOILS AND SOME RECLAMATIONAL FEATURES OF THE TERRITORY OF CITY SARAN' AND THE VILLAGE SHAKHAN IN KARAGANDA REGION. (Rus) Akad. Nauk Kazakhskoi SSR. Inst. Pochvoved. Trudy. 11: 92-126. maps. Ref. 1960. 56.9 AL6

2434. Amson, F. W. Van. SOIL RESEARCH IN RELATION TO THE PLANNING IN SURINAM. (Du) Surinaamse Landb. 12(3): 84-87. 1964. 9.6 Su7
English summary.

A report was given of present and needs of future research in Surinam on drainage.

2435. Anderson, J. R., and Dill, H. W. LAND CLEARING AND DRAINAGE IN EASTERN NORTH CAROLINA. U.S. Dept. Agr., Agr. Res. Serv., ARS-43-127, 47 pp. 1961. A281.9 R313A

A report was given on recent land drainage and clearing operations in selected areas of the Coastal Plain of eastern North Carolina. The costs and benefits of clearing and draining land were given along with the characteristics of the land cleared and drained, the types of equipment used, and the uses made of the land on which the improvements were made.

2436. Andrijauskaite, E. EFFECT OF DRAINAGE ON WATER PROPERTIES OF CLAY AND LOAMY SOILS. (Rus) Pochvovedenie. 1961(3): 89-95. Mar. 1961. 57.8 P34
English translation—Soviet Soil Sci. 3: 312-318. Mar. 1961. 57.8 P34Ae

A report was given on the effect of drainage on the physical properties of clay and loamy soils in the Lithuanian SSR.

2437. Antipov-Karataev, I. N., and Kader, G. M. MELIORATIVE EVALUATION OF IRRIGATION WATER WITH ALKALINE REACTION. (Rus) Pochvovedenie. 1961(3): 60-65. Ref. Mar. 1961. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 3: 283-287. Ref. Mar. 1961. 57.8 P34Ae

A report was given on the evaluation of alkaline irrigation water and their effect on soils in the U.S.S.R. The improvement of irrigation water with a high pH by the use of gypsum was reported.

2438. Arany, S. THE USE OF ALKALINE WATERS FOR IRRIGATION. Cong. Internatl. de la Sci. du Sol. Rap. 6(D Comn. VI): 615-619. 1956. 56.09 In8452

A report was given on the effect of alkaline irrigation water on soils in Hungary. The effect was given of leaching plus gypsum for their improvement.

2439. Arkhipova, E. P. FEATURES OF THE SOIL THERMAL REGIME ON DRIED BOGS. (Rus) Met. i Gidrologiia. 8: 32-35. Aug. 1956. 345 M56

2440. Aslyng, H. C. PHYSICAL AND CHEMICAL CONDITIONS OF DANISH MARSH LAND. (Da) Tidsskr. f. Planteavl. 59: 328-344. Ref. 1955. 11 T439
English summary.

Physical and chemical conditions of drained marsh lands in Denmark were given. The areas are drained to a depth of 70 cm. Part of the area has been reclaimed by the use of superphosphate or gypsum. The rate of infiltration of water and the soil structure was improved.

2441. Averyanov, S. F. DEMINERALIZING EFFECT OF DRAINAGE. Internatl. Comn. Irrig. and Drain. Annu. B. 1958: 4-13. Ref. 1958. 55.9 In8A

The effects of the main chemical elements of the soil from drainage from irrigated areas and the influence on the ground water balance were studied in the U.S.S.R. Laboratory research on the effects of irrigation and deep drainage on the reclamation of saline soils was also reported.

2442. Babcock, K. L., Carlson, R. M., Schulz, R. K., and Overstreet, R. A STUDY OF THE EFFECT OF IRRIGATION WATER COMPOSITION ON SOIL PROPERTIES. Hilgardia. 29: 155-164. 1959. 100 C12H

Lysimeter experiments designed to study the quality of irrigation waters were initiated in 1953. The principal objective was to observe the effects of Na and HCO_3 in the water on the chemical properties of the soil. After being cropped to alfalfa for four years, the soil was found to have significant salt gradients with depth. In many cases, there was an appreciable formation of exchangeable Na, and "excess cation saturation" had been induced. Extensive chemical analyses were reported.

2443. Baden, W. PROVINCIAL BIOLOGICAL FORMATION OF CULTIVATED RAISED BOGS. (Sum.) Internatl. Union Conserv. Nat. and Nat. Resources Proc. and Papers Tech. Mtg. 6: 162-163. 1956, pub. 1957. 279 In84Pt

A report was given of the altering of the biological equilibrium of virgin raised peat bogs when they are artifically drained.

2444. Baden, W. GOOD AND BAD, POOR AND RICH SOILS. (Ge) Mitt. der Deut. Landwirt.-Gesell. 74(39): 1130-1132. Sept. 24, 1959. 18 N39

2445. Balakrishnan, M. R., and Attayodhin, C. THE DRAINAGE PROBLEM IN DIVERSIFIED AGRICULTURE UNDER IRRIGATION. Cong. Irrig. and Drainage Trans. 3(3): 8.323-8.332. 1957. 55.9 C7652

A report was given on the field crop trials in Thailand to study the drainage needs of diversified agriculture under irrigation.

2446. Baranowski, A. PROPERTIES OF THE YOUNGEST POLDER MARZECINO SOILS OF THE VISTULA DELTA. (Pol) Rocs. Gleboznawcze. 11: 117-145. maps. Ref. 1962. 56.8 R592
English summary.

A report was given on some chemical and physical analysis of soils of a polder in Poland which was brought into cultivation in 1954.

2447. Barker, M. G. A DRAINAGE INVESTIGATION ON A CLAY SOIL. Roy. Agr. Soc. Eng. J. 124: 50-59. 1963. 10 R81

A report was given on a tile drainage investigations on clay soil for wheat crops in England.

2448. Bartoszek, T. IMPROVEMENT INVESTMENTS IN 1962. (Pol) Nowe Roln. 12(4): 32-33. Feb. 15/28, 1963. 20.5 N86

2449. Batchelder, A. R., Lunin, J., and Gallatin, M. H. SALINE IRRIGATION OF SEVERAL VEGETABLE CROPS AT VARIOUS GROWTH STAGES. II. EFFECT ON CATION COMPOSITION OF CROPS AND SOILS. Agron. J. 55: 111-114. 1963. 4 Am34P

Tomatoes, broccoli, onions, and peppers (medium salt tolerant crops), and beets, and spinach (high salt tolerant crops) were grown in a greenhouse to determine the effects on saline irrigations at various growth stages on the growth and cation composition of vegetable crops. The saline treatments were applied at three different growth stages. The treatments consisted of a control receiving only demineralized water and 4 levels of salinity, which consisted of synthetic sea water diluted to give electrical conductivity (EC) values of 5, 10, 20, and 30 mmhos./cm. for the medium salt tolerant crops and 10, 25, 40, and 50 mmhos./cm. for the high salt tolerant crops.

2450. Battistelli, E. THE SCOURGE OF DAMP SOILS. (It) Riso. 11(2): 21. Feb. 1962. 59.8 R49

2451. Bazin, F. GROUND WATER LEVEL CONTROL IN DRAINED LAND. (Fr) Cong. Irrig. and Drain. Trans. 5(5): R.17.193-R.17.197. 1963. 55.9 C7652
English summary.

A report was given on the value of keeping ground water level control on drained areas where subsidence is a threat.

2452. Beer, C. E., David, H. T., and Shrader, W. D. RESPONSE OF CORN YIELDS IN A PLANOSOL SOIL TO SURFACE DRAINAGE, CROPPING SYSTEM AND VARIABLE FERTILIZER TREATMENTS. Iowa Agr. and Home Econ. Expt. Sta. Res. B. 499: 327-336. 1961. 100 Io9

Surface drainage (bedding) is not feasible on a planosol soil (claypan soils of flat lands) for conditions comparable to those described in this experiment, which include 100-foot-wide beds, 0.15 percent grade in the channel, and tillage operations performed at right angles to the channel grade. A summary for the years 1954 through 1959 showed that the average corn yield was higher on some of the bedded plots than on the level plots, while, in other cases, there was a yield depression in the bedded plots. The magnitude of the difference between the level and bedded plots was dependent upon the type of cropping system used. The yield on the bedded plots was depressed about 12.5 percent in the continuous corn system, while, in the COM rotation, a slight (2 percent) increase in yield was obtained.

The results showed that within the continuous corn plots, the difference in yields between the bedded and level plots was significantly greater for the higher rates of nitrogen application (30, 60, 120, and 240 pounds per acre) than for the lower fertilizer rates (0, 30 pounds per acre nitrogen, and phosphorous factorial).

2453. Beer, C. E., and Shrader, W. D. RESPONSE OF CORN YIELDS TO BEDDING SOILS. Agr. Engin. 42(11): 618-621. Nov. 1961. 58.8 Ag83

Some field results were given on the response of corn yields to bedding (land forming) on Edina (claypan) soils in Iowa. The yields on the bedded plots were depressed about 12.5 percent in the continuous corn system while in the C-O-M rotation, a slight (2 percent) increase in corn yield was obtained.

2454. Begei, S. V. EXPERIENCE IN DRAINING AND UTILIZING RECLAIMED SOILS IN THE CARPATHIAN FOOTHILLS. (Rus) Gidrotekh. i Melior. 1960(4): 41-44. Apr. 1960. 290.8 G362

2455. Bel'skaya, M. A. VARIATION IN THE PHYSICAL PROPERTIES OF PEAT-BOG FOREST SOILS UNDERGOING RECLAMATION THROUGH DRAINAGE. (Rus) Leningrad Nauch.-Issled. Inst. Lesn. Khoz. Sborn. Rabot po Lesn. Khoz. 4: 170-179. 1961. 99.9 L545

2456. Berdyev, O. THE EFFECTIVENESS OF USING DRAINAGE ON THE SALINE SOILS OF CHARDZHOU REGION. (Rus) Sel'sk. Khoz. Turkmenistana. 1961(1): 64-65. Jan./Feb. 1961. 20 Se4982

2457. Bernstein, L. SALT TOLERANCE OF GRASSES AND FORAGE LEGUMES. U.S. Dept. Agr., Agr. Inform. B. 194, 7 pp. 1958. 1 Ag84Ab

The salt tolerance of grasses and forage legumes were discussed.

2458. Bernstein, L. THE SALT TOLERANCE OF PLANTS. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 201-202. Jan. 1958. 55.9 C7693

Soil, climatic factors, and management practices exert strong modifying influences on the relationship of plant growth to irrigation water quality. Thus, while plant response may be adequately described in terms of soil salinity, exchangeable-sodium-percentage, and related soil variables, a statement of the relationship of plant growth to irrigation-water quality must be flexible enough to allow for the modifying influences of soil, climate, and management.

For most crops of low or moderate salt tolerance the inhibitory effects of salinity become progressively greater as salinity increases. In addition to stunting, other characteristics of salt-retarded plants include a blue-green color of the foliage and smaller leaves.

The range of salt tolerance varies from injury or partial growth inhibition, at as low a level as 2 to 3 millimhos for the most sensitive crops (beans, clovers, many fruit trees), to an ability to tolerate salinities of 10 to 15 millimhos or more, in such crops as sugar beets, barley, and cotton.

2459. Bernstein, L. SALT TOLERANCE OF VEGETABLE CROPS IN THE WEST. U.S. Dept. Agr., Agr. Inform. B. 205, 5 pp. 1959. 1 Ag84Ab

The salt tolerance of vegetable crops in the Western United States were discussed.

2460. Bernstein, L. THE SALT TOLERANCE OF FIELD CROPS. U.S. Dept. Agr., Agr. Inform. B. 217, 6 pp. 1960. 1 Ag84Ab

A report was given on the salt tolerance of field crops.

2461. Bernstein, L. TOLERANCE OF PLANTS TO SALINITY. J. Irrig. and Drain. Div., ASAE 87(IR 4): 1-12. Dec. 1961. 290.9 Am3Ps

A report was given on crop response to salinity. The use of saline waters for irrigation requires that larger quantities of water be applied to promote leaching and to minimize the relative degree of salt accumulation on the root zone of the crop.

2462. Bernstein, L. SALT-AFFECTED SOILS AND PLANTS. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 18: 139-174. Ref. 1962. 278.9 Un3

A discussion and a review of the literature were given on salt-affected soils and plants in arid regions. High water tables and fluctuating water tables were held responsible for many of the salt-problem soils described.

2463. Bernstein, L. REDUCING SALT INJURY TO ORNAMENTAL SHRUBS IN THE WEST. U.S. Dept. Agr. Home and Garden B. 95, 6 pp. (1964) illus. May 1963. 1 Ag84Hg

A report was given on the effect of salinity on ornamental shrubs in the Western United States and methods used to reduce salt injury in that section.

2464. Bernstein, L. TOLERANCE OF PLANTS TO SALINITY. Amer. Soc. Civil Engin. Trans. 128(3): 561-572. 1963. 290.9 Am3

Soluble salts tend to accumulate in soils in arid regions and are a potential hazard wherever irrigation is practiced. Plant response is primarily determined by the osmotic pressure of the soil solution to which the electrical conductivity of the saturation extract of soils is closely enough related to provide a useful index of salinity. Specific ion effects, involving nutrition or direct toxicity, affect certain crops under some conditions. Climate, irrigation frequency, and other management practices may modify the salt tolerance of plants. Varietal differences in salt tolerances are not usually of practical importance for most crops, but rootstock specificities regulating the accumulation of potentially toxic ions are of major importance for many fruit crops. Plant response to a given irrigation water cannot be predicted without taking into account the probable effects of the conditions under which the water will be used on the resultant level of soil salinity. The use of more saline water requires that larger quantities of water be applied to promote leaching and to minimize the relative degree of salt accumulation in the root zone of the crop.

With discussion by Messrs. J. E. Christiansen; Harry F. Blaney; Arthur F. Pillsbury; O. R. Lunt; R. H. Brooks; and Leon Bernstein. pp. 572-579.

2465. Bernstein, L. EFFECTS OF SALINITY ON MINERAL COMPOSITION AND GROWTH OF PLANTS. Internatl. Colloquim Plant Anal. and Fert. Prob. Proc. Brussels, 4: 25-45. 1964. 463.34 C69

The effects of salinity on mineral composition and the growth of plants were reported.

2466. Bernstein, L. SALINITY AND ROSES. Amer. Rose Annu. 1964: 120-124. 1964. 81 Am31A

A discussion was given on the effect of salinity on roses.

2467. Bernstein, L. SALT TOLERANCE OF PLANTS. U.S. Dept. Agr., Agr. Res. Serv. Agr. Inform. B. 283, 23 pp. 1964. 1 Ag84Ab

The electrical conductivity of the saturation extract of soils, a measure of total salinity, adequately describes the effective salt content of the soil for most crop situations. Since many fruit crops, trees, and shrubs are sensitive to chloride and sodium, the additional determination of these elements in the saturation extract is often advisable.

Analysis of plant samples is useful in detecting nutritional effects of salinity and in diagnosing toxic accumulations of chloride or sodium in fruit crops, trees, and shrubs.

2468. Bernstein, L., and Fireman, M. LABORATORY STUDIES ON SALT DISTRIBUTION IN FURROW-IRRIGATED SOIL WITH SPECIAL REFERENCE TO THE PRE-EMERGENCE PERIOD. Soil Sci. 83(4): 249-263. Ref. Apr. 1957. 56.8 So3

A report was given on a laboratory study of the salt distribution in furrow irrigated soils.

2469. Bernstein, L., and Hayward, H. E. PHYSIOLOGY OF SALT TOLERANCE. Annu. Rev. Plant Physiol. 9: 25-46. 1958. 450 An78

A review of the literature was given on the understanding of the physiology of salt tolerance of plants. The excessive accumulation of soluble salts in the rhizosphere is a potential if not an actual limiting factor for the productivity of irrigation agriculture everywhere. Recently, widespread interest in the beneficial effects of supplemental irrigation during periods of drought has extended the concern with salt problems to the humid eastern sections of the country. Salt-spray damage and salt-water intrusions along the coast, and salinity problems in greenhouse operations represent additional focal points of interest in salinity.

2470. Bernstein, L., MacKenzie, A. J., and Krantz, B. A. THE INTERACTION OF SALINITY AND PLANTING PRACTICE ON THE GERMINATION OF IRRIGATED ROW CROPS. Soil Sci. Soc. Amer. Proc. 19: 240-243. 1955. 56.9 So3

The influence of bed shape, planting, and irrigation practice on the germination of row crops on a series of artificially salinized plots was determined at Riverside and Brawley, Calif. Three experiments were conducted, testing 4 bed types with a total of 8 crops. The salinity status of the soil in the plow layer prior to bedding-up may be used to predict the probable success of various planting practices. Flat-topped single row beds present the greatest salinity hazard.

2471. Black, J. D. F. SOIL MANAGEMENT FOR WINTER DRAINAGE IN "SOUTHERN" ORCHARDS. Victorian Hort. Digest. 5(4): 21-23. Nov. 1961/Jan. 1962. 80 V662

A report was given on the effect of soil management for winter drainage in orchards in Australia. More orchard trees died under winter waterlogged conditions under mulch than clean cultivation. Trees under annual of perennial pastures showed no water damage.

2472. Blintsov, I. K. CHANGE OF THE PLANT COVER AND OF THE PRODUCTIVITY OF PINE PLANTATIONS AS A RESULT OF DRAINAGE. (Rus) Vsesoyuzn. Bot. Obshch. Belorusskoe Otd. Sborn. Bot. Rabot. 3: 153-157. 1961. 451 V967

2473. Blosser, R. H. DRAINAGE HELPS TO GET BEST RESULTS FROM FERTILIZER. Ohio Farm and Home Res. 44(319): 57, 63. July/Aug. 1959. 100 Oh3S

A report was given on the effect of drainage on the increased yields of crops from fertilizer application in Ohio.

2474. Blosser, R. H. GOOD DRAINAGE MAKES MORE FERTILIZER PROFITABLE. Better Crops Plant Food. 43(6): 28-30. Nov./Dec. 1959. 6 B46

A report was given on the need of good drainage to make fertilizers more profitable on Paulding and Hoytville soils.

2475. Blosser, R. H. HOW DRAINAGE AFFECTS THE ECONOMICS OF FERTILIZER USE ON A FINE TEXTURED SOIL. J. Soil and Water Conserv. 15(5): 210-213. Sept. 1960. 56.8 J822

A report was given on the affects of drainage on the economics of fertilizer use on Paulding soils in Ohio.

Data indicated that on many of these poorly drained soils, more tile lines and surface drains were needed to make heavy application of commercial fertilizer profitable.

2476. Blumel, F. SOIL STRUCTURE CHANGES BY MOLE DRAINAGE. (Ge) Oesterr. Wasserwirt. 8(11): 313-319. Ref. Nov. 1956. 55.8 Oe8

2477. Bobchenko, V. I. SUBSURFACE MOLE IRRIGATION AND THE EFFECT OF ARTIFICIAL MOLES ON THE SOIL AND PLANT. (Rus) Vsesoliuzn. Soveshchanie po Prob. "Biol. Osnovy Oroshaemogo Zeml." Sborn. Statei. 1955: 91-104. 1957. 55.9 V96

2478. Bonnet, J. A. POORLY DRAINED SOILS OF PUERTO RICO HAVE CONTRIBUTED TO SUGAR YIELD DECLINE. Sugar J. 26(1): 38, 40-41, 43-44. Ref. June 1963. 65.8 Su391

A report was given on the decline of sugar yields in Puerto Rico due to poor drainage. It was recommended that watershed projects be started in area and increased Federal and local aid and finicial assistance be given for the design and construction of field drainage systems. The following recommendations were given to the farmer: (1) Lower the water table depth as much as possible; (2) increase the rate of pump drainage (where used) 2 to 4 weeks before sugarcane harvest; and (3) perform subsoil, subsoil-mole, or subsoil-vertical mulching operations combined with increased fertilization.

2479. Borenska, L. INFLUENCE OF "MOLE ELLAGE" AND TERRACING ON A SLOPE UPON CROP YIELDS. (Pol) Olsztyn. Wyzsza Szkola Roln. Zeszyty Nauk. 12(2): 299-304. 1962. 20.5 OL8

2480. Boschma, K. DRAINAGE IN HORTICULTURE. (Du) Groenten en Fruit. 13(32): 989-990. (Cont.) Feb. 6, 1958. 80 G89

2481. Boschma, K. DRAINAGE IN HORTICULTURE. II. (Du) Groenten en Fruit. 13(34): 1056-1057. Feb. 20, 1958. 80 G89

2482. Boschma, K. WATER CONTROL ON INTENSIVE HORTICULTURAL HOLDINGS. (Du) Nederland. Heidemaatsch. Tijdschr. 71(6): 177-182. June 1960. 12 N282

2483. Bottini, O. TRADITION AND RESEARCH IN ITALY IN THE USE OF BRACKISH WATER FOR IRRIGATION. (It) Georgofili (ser. 7)6(1/2): 195-207. 1959. 507 F51

2484. Bower, C. A. EFFECT OF WATER QUALITY ON SEEPAGE THROUGH SOIL. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 76-77. Jan. 1965. A56.9 R31

A report was given on the effect of water quality on water seepage through soil.

2485. Bower, C. A., and Maasland, M. SODIUM HAZARD OF PUNJAB GROUND WATERS. West Pakistan Engin. Conf. Proc. 1963: 49-61. 1963.

Carbonates in irrigation waters may precipitate in soils as $CaCO_3$, and the precipitation enhances the tendency of the soil to accumulate exchangeable Na from the water. The fraction of carbonate applied in irrigation water which precipitates in soil is variable and is influenced by several factors including the relative and absolute concentrations of Ca+Mg and CO_3+HCO_3 in the water, the Ca+Mg, CO_2, and pH status of the soil, and the degree to which the ionic concentrations of the soil solution increase owing to loss of water by evapotranspiration. The extent to which exchangeable Na accumulates in soils irrigated with high carbonate waters depends upon the SAR of the water as well as upon the fraction of applied carbonate that precipitates as $CaCO_3$.

2486. Boyko, H., and Boyko, E. PRINCIPLES AND EXPERIMENTS REGARDING DIRECT IRRIGATION WITH HIGHLY SALINE AND SEA WATER WITHOUT DESALINATION. N.Y. Acad. Sci. Trans. (ser. 2)26(8, sup.): 1087-1102. Ref. July 1964. 500 N484T

A lysimeters study in Israel was reported on the effect of direct irrigation with highly saline and sea water without desalination.

2487. Bradford, G. R. LITHIUM SURVEY OF CALIFORNIA'S WATER RESOURCES. Soil Sci. 96: 77-81. 1963. 56.8 So3

Four hundred water samples, representative of the water resources of California were analyzed for their lithium content. Lithium concentration versus geographical area and relation to other cations were discussed. Approximately 25 percent of the samples contained more than 0.05 p.p.m. lithium, and may, therefore, produce undesirable effects on the growth of citrus and other lithium-sensitive crops where soil type and other factors favor lithium accumulation. Samples with a high lithium content were more frequently observed to be associated with low magnesium and/or a high sodium percentage.

2488. Brandyk, T. RESULTS OF INVESTIGATIONS ON IRRIGATION OF MEADOWS GROWING ON OVERDRYED PEAT SOIL. (Pol) Zeszyty Prob. Postepow Nauk Roln. 34: 31-46. 1962. 20.5 Z5 English summary.

Investigations were reported on the irrigation of meadows growing on overdried peat soils in the Nortec River Valley of Poland.

2489. Breazeale, E. L., and McGeorge, W. T. EFFECT OF SALINITY ON THE WILTING PERCENTAGE OF SOIL. Soil Sci. 80: 443-447. 1955. 56.8 So3

A technique was given that can be used to determine the effect of salinity on the wilting percentage of the soil. It was suggested that the same technique can be employed with other plants that readily develop stem roots in a similar environment.

2490. Briones, A. A. MINERALOGICAL STUDIES OF SOME DRAINED AND RECLAIMED PADDY SOILS. Philippine Agr. 47(8): 419-434. Jan. 1964. 25 P542

A report was given on a mineralogical study of some drained and reclaimed paddy soil in Hawaiian and Philippine soils.

2491. Broadfoot, W. M. REACTION OF HARDWOOD TIMBER TO SHALLOW-WATER IMPOUNDMENTS. Miss. Agr. Expt. Sta. Inform. Sheet 595, 2 pp. 1958. 100 M691n

In recent years, farmers and sportsmen have built many temporary shallow-water impoundments in southern hardwood forests to attract waterfowl.

The impoundments are generally created by constructing low dikes and dams in flats and sloughs. They are built in time to catch the rains of fall and early winter, as most of the low lands are dry by late autumn. When rains are light or delayed, water is sometimes pumped into the diked areas from wells, streams, or canals. Impoundments in oak woodlands are especially attractive to mallard ducks, which feed on the mast.

Some forest owners are concerned that the water might damage the trees. The Southern Forest Experiment Station studied 16 impoundments in Mississippi and Arkansas, representing a variety of flooding conditions. Briefly, the study showed that impoundments increased the amount of water that went into soil storage; this extra moisture was especially beneficial to trees during dry summers. The impoundments should be drained promptly each spring. Letting the water stand all year reduced growth for most tree species, and killed others.

2492. Brooks, R. H., Goertzen, J. O., and Bower, C. A. PREDICTION OF CHANGES IN THE COMPOSITION OF THE DISSOLVED AND EXCHANGEABLE CATIONS IN SOILS UPON IRRIGATION WITH HIGH-SODIUM WATERS. Soil Sci. Soc. Amer. Proc. 22(2): 122-124. 1958. 56.9 So3

A theory for describing the process of cation exchange during passage of a salt solution through an exchangeable column was successfully applied to a soil in a field.

2493. Brown, J., Grant, C. L, Ugolini, F. C., and Tedrow, J. C. F. MINERAL COMPOSITION OF SOME DRAINAGE WATERS FROM ARCTIC ALASKA. J. Geophysical Res. 67: 2447-2453. 1962. 470 J823

Columns of synthetic ion-exchange resin were used to sample the exchangeable cations in drainage waters of northern Alaska. Details of the sampling and analytical procedures were presented. For the elements Na, K, Mg, Ca, Sr, and Ba, an average recovery of 96 percent was found on a typical smaple. For most trace elements recovery was low.

2494. Bruns, V. F., and Yeo, R. R. TOLERANCE OF CERTAIN CROPS TO SEVERAL AQUATIC HERBICIDES IN IRRIGATION WATER. U.S. Dept. Agr., Agr. Res. Serv. Tech. B. 1299, 22 pp. 1964. 1 Ag84Te

A report was given on field and greenhouse experiments on the effect of aromatic solvents and herbicides used to control aquatic weeds in reservoirs.

2495. Bulavko, A. G. THE EFFECT OF DRAINAGE ON EVAPORATION AND RUNOFF IN THE BELORUSSIAN POLESYE. (Rus) Gidrotekh. i Melior. 1960(1): 14-18. Jan. 1960. 290.8 G362

2496. Bululukov, Y. G., and Vasil'eva, E. I. FEATURES OF THE MOISTURE-SUPPLY AND CONDITION OF FOREST CROPS ON STEP TERRACES. (Rus) Lesn. Khoz. 1960(10): 40-41. Oct. 1960. 99.8 L5622

2497. Burke, W. DRAINAGE INVESTIGATION ON BOGLAND: THE EFFECT OF DRAIN SPACING ON GROUND WATER LEVELS. Irish J. Agr. Res. 1(1): 31-34. 1961.

Drains installed in blanket peat have a very localized effect. A lowered ground water level was found only to a distance of 5 or 6 feet from the edge of the drain. Hence with drain spacings of 25, 50, and 100 feet, the areas remaining undrained were respectively 60, 80, and 90 percent. There was a maximum seasonal fluctuation of 12 inches in the water table, but no permanent drainage effect.

2498. Burns, B. E. SOME EFFECTS OF ARTIFICIAL DRAINAGE UPON AGRICULTURE IN BLUE EARTH COUNTY, MINNESOTA. Minn. Acad. Sci. Proc. 23: 82-83. 1955. 500 M663

A report was given of the value of artifical drainage upon agriculture in Blue Earth County, Minn. The drainage has enabled the county to assume active part in Corn Belt agriculture and has added to the economic growth and stability of the agricultural resources of the nation.

2499. Burns, R. M., Miller, M. P., Harding, R. B., Gowans, K. D., and Zentmyer, G. A. POOR DRAINAGE AND EXCESS SOIL MOISTURE ENCOURAGE SPREAD OF AVOCADO ROOT ROT. Calif. Agr. 17(8): 13. map. Aug. 1963. 100 C12Cag

A report was given on the spread of avocado root rot in California by poor drainage and excess soil moisture.

2500. Bush, K. K. DRAINAGE EFFECT ACCORDING TO FOREST TYPES IN LATVIAN SSR. (Rus) Lesn. Khoz. 10(11): 26-30. Nov. 1957. 99.8 L5622

2501. Bush, K. K. EFFECT OF INTENSITY OF DRAINAGE ON THE PRODUCTIVITY OF PINE FORESTS OF THE MOLINIA AND OF THE CAREX-PHRAGMITES TYPES. (Rus) Akad. Nauk Latviiskoi SSR. Inst. Lesokhoz. Prob. Trudy. 22: 139-151. Ref. 1961. 99.9 R44

2502. Cairns, R. R. SOME MOISTURE RELATIONS IN A SOLONETZIC SOIL COMPLEX. Canad. J. Soil Sci. 42(1): 17-22. Feb. 1962. 56.8 C162

Field studies of some moisture conditions in Canada in a Duagh-Malmo Solonetzic soil complex revealed that the depth of soil drying was closely related to the degree of solodization. It was suggested that a nutritional problem may have a significant bearing on water utilization by plants grown on these soils.

2503. Caldeira, F. M. THE NEED FOR DRAINAGE IN RICE LANDS. (Por) Lav. Arroz. 16(183): 90-91. Apr. 1962. 59.8 L39

2504. Calembert, J. CONTRIBUTION TO THE STUDY OF THE DRAINAGE OF THE CLAYEY SOILS OF FAMENNE. (Fr) Gembloux. Inst. Agron. B. de l'Inst. Agron. et des Sta. de Rech. de Gembloux 30(3/4): 249-259. 1962. 105.1 G285

2505. Calzecchi-Onesti, A. AIR SPACE AND DRAINAGE. (It) Gior. de Agr. 66: 97-98. Mar. 11, 1956. 16 It1G

2506. Calzecchi-Onesti, A. DRAINAGE AND WATER CONDITIONS OF THE SOIL. (It) Gior. di Agr. 66: 157-158. Apr. 22, 1956. 16 It1G

2507. Carter, D. L. WATER QUALITY. In GUIDE FOR CITRUS PRODUCTION IN THE LOWER RIO GRANDE VALLEY. Tex. Agr. Expt. Sta. B. 1002: 6-7. Dec. 1963. 100 T31S

A discussion was given on the effect of saline irrigation water on citrus production in the Lower Rio Grande Valley of Texas.

2508. Carter, D. L. SALINITY PROBLEMS. In GUIDE FOR CITRUS PRODUCTION IN THE LOWER RIO GRANDE VALLEY. Tex. Agr. Expt. Sta. B. 1002: 10-11. Dec. 1963. 100 T31S

A discussion was given on salinity problems for citrus production in Texas.

2509. Carter, D. L., and Myer, V. I. SOIL CHEMICAL AND PHYSICAL PROPERTIES ASSOCIATED WITH DEPRESSIONAL SALINE AND ADJACENT AREAS IN TWO GRAPEFRUIT GROVES. J. Rio Grande Valley Hort. Soc. 18: 51-59. 1964. 81 L95

Some chemical and physical properties of saline, transitional, and unaffected soils in two grapefruit groves were studied in relation to tree growth, surface elevation, and depth to the water table.

The saline soils contained extremely high salt concentrations in the surface few inches but salt concentration decreased sharply with depth. Transitional soils contained salt concentrations near the critical level for grapefruit trees. Unaffected soils were low in salt.

2510. Carter, D. L., and Peterson, H. B. SODIC TOLERANCE OF TALL WHEATGRASS. Agron. J. 54: 382-384. 1962. 4 Am34P

Tall wheatgrass grew and produced well at ESP (exchangeable-sodium-percentage) levels between 50 and 60 under field conditions. In the greenhouse, tall wheatgrass germinated and produced at ESP levels of 60, with transplants exhibiting superior performance. Seeds germinated with no adverse effects at pH levels up to 9.7. Plants grew at pH levels of 10.0 in solution culture.

2511. Carter, D. L., Wiegand, C. L., and Allen, R. R. THE SALINITY OF NONIRRIGATED SOILS IN THE LOWER RIO GRANDE VALLEY OF TEXAS. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-98, 35 pp. 1964. A56.9 R31

Results of two separate but similar studies were combined to present basic chemical, physical, and mineralogical properties of soils of the nonirrigated area in the Lower Rio Grande Valley of Texas in locations classified saline, transitional, and nonsaline on the basis of plant growth. These results were summarized and presented for use in planning future reclamation and management programs for that area.

2512. Carvalho-E-Vasconcellos, J. De. FROM SALT MARSHES TO RICE FIELDS. (Sp) Lisboa, 1960. 30 pp. Ref. 1960. 59.24 C25D
English summary.

A comparison was made of the vegetation of salt marshes and of reclaimed areas planted to rice in Portugal. The different salt marsh soil types were discussed along with recommendations for their reclamation as rice fields.

2513. Cassidy, N. G. A VARIETAL DIFFERENCE IN THE NEED OF BANANAS FOR GOOD DRAINAGE. Fiji. Dept. Agr., Agr. J. 29(4): 133-136. Dec. 1959. 25 F47Ag.

A report was given on the variety differences on bananas to good drainage in Fiji.

2514. Chamblee, D. S., and Gilbert, W. B. THE INFLUENCE OF DRAINAGE ON THE GROWTH OF FORAGE PLANTS, 1958. N.C. Agr. Expt. Sta. Dept. Field Crops. Res. Rpt. 11, 14 pp. Nov. 1958. 100 N8122

A report was given on the influence of drainage on the growth of various types of forage plants in North Carolina.

2515. Chang, C. W. EFFECTS OF SALINE IRRIGATION WATER AND EXCHANGEABLE SODIUM ON SOIL PROPERTIES AND GROWTH OF ALFALFA. Soil Sci. 91(1): 29-37. Ref. Jan. 1961. 56.8 So3

A report was given on the effect of saline irrigation water and exchangeable sodium on soil properties and growth of alfalfa.

2516. Chang, T. T. A COMPARISON OF THE SOIL AND WATER LOSSES AS WELL AS THE SUGARCANE PRODUCTION BETWEEN THE TERRACED AND UNTERRACED FIELDS. Taiwan Sugar. 6(7): 16-22. July 1959. 65.8 T133

A comparison was made between soil and water losses and sugarcane production between terraced and unterraced fields in Taiwan. The runoff in the terraced field decreased 26 percent, soil loss decrease 93 percent, and sugarcane production increased 12 percent.

2517. Chang, Y. C. THE EFFECT OF DEEP PLOUGHING AND HEAVY FERTILIZATION ON THE YIELD OF RICE IN KOREA. Int. Rice Comm. Newslett. 1963(spec. issue): 141-142. 59.9 In83N

A report was given on the value of deep plowing and heavy fertilization on rice yields in Korea.

2518. Chaudhry, M. S., and McLean, E. O. COMPARATIVE EFFECTS OF FLOODED AND UNFLOODED SOIL CONDITIONS AND NITROGEN APPLICATION ON GROWTH AND NUTRIENT UPTAKE BY RICE PLANTS. Agron. J. 55: 565-567. 1963. 4 Am34P

A greenhouse experiment in which rice was grown both under flooded and unflooded soil conditions was conducted to examine some possible causes for the common observation that submergence is the key to successful rice culture. Nitrogen was applied at different stages of plant growth in order to obtain information on how the rice crop might perform under the different soil conditions imposed.

Plants grew better under flooded conditions than under unflooded conditions. They were healthier and taller and the effective tillers were thicker and more numerous under flooded conditions. This was accompanied by the development of more fibrous and apparently healthier roots of higher cation exchange capacity (CEC). The most striking effects of the unflooded conditions were: Delayed flowering; very high percentage of sterility; and a significant reduction in grain yields. Application of nitrogen generally increased the CEC of roots but increased yields significantly only when applied to the flooded soil at the tillering state. Low phosphorus and manganese contents of the plant were associated with poor performance of rice grown under unflooded conditions.

2519. Cheaney, R. L. EFFECT OF TIME OF DRAINING OF RICE ON THE PREVENTION OF STRAIGHTHEAD. Tex. Agr. Expt. Sta. Prog. Rpt. 1774. 1955. 100 T31P

Century Patna 231 is very susceptible to straighthead on sandy soil but this condition can be controlled in such susceptible varieties by draining the irrigation water from the field just prior to the jointing or stem elongation stage (about 50 days after emergence). Where the supply of irrigation water may be short, a resistant variety should be planted.

2520. Chippindale, H. G. THE RESTORATION OF GRASSLAND FLOODED BY SEA WATER. Agr. Prog. 29: 25-33. Ref. 1954. 10 Ag86

The effects of sea water on soil vegetation were summarized as follows: (1) Surface vegetation was scorched by a high concentration of salt in the flood water; (2) if plants were submerged for more than a few days beneath any considerable depth of water, asphyxiation of most species occurred irrespective of the salt concentration; (3) the entrance of sea water into the soil raised the salt concentration to a level that inhibited the growth of all except a very few of the plants usually found on agricultural land, and when the concentration of salt in the soil was maintained for any considerable time most agricultural species were killed; (4) the sodium ion in sea water had a pronounced effect on soil structure, especially in relation to the clay fraction of the soil and this seriously effected drainage; (5) following flooding, plant growth showed a marked shortage of nitrogen and sometimes of phosphate; and (6) the soil fauna was in some degree destroyed.

2521. Clark, H. L., and Juve, R. L. EFFECTS OF SALINE WATER FROM HURRICANE "AUDREY" ON SOILS. Agron. J. 54: 390-392. 1962. 4 Am34P

Inundation by salt water from Hurricane "Audrey" strongly affected the salinity of most soils. Salt marsh range soils and permeable ridge soils were least affected. Fresh marsh soils and slowly permeable ridge soils were most affected. The storm-caused salinity decreased significantly for 14 months where the soils were not subject to salt water tides. Prestorm level of production of vegetation on areas studied was reached within two growing seasons.

2522. Cointepas, J. P., and Roederer, P. FIRST RESULTS OF THE DEVELOPMENT OF SALINITY IN SOIL THROUGH IRRIGATION WITH SALT WATER IN TUNISIA. (Fr) Ann. Agron. 12(1): 121-126. 1961. 14 F8499

2523. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON IRRIGATION WATER: A SELECTIVE BIBLIOGRAPHY (1964-1957). Commonwealth Bur. Soils [Annot. Bibliog.] 739, 16 pp. 1964. 241 C734A

An annotated bibliography was given on irrigation water quality and its effect on crops and soils for the period, 1957 to 1964.

2524. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON TOLERANCE OF CROP PLANTS TO SODIUM (1964-1957). Commonwealth Bur. Soils [Annot. Bibliog.] 767, 14 pp. 1964. 241 C743A

An annotated bibliography was given on tolerance of crop plants to sodium for the period 1957 to 1964.

2525. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON IMPROVEMENT AND DEMINERALIZATION OF IRRIGATION WATER (1964-1946). Commonwealth Bur. Soils [Annot. Bibliog.] 793, 5 pp. 1964. 241 C734A

An annotated bibliography was given on improvement and demineralization of irrigation water for the period 1946 to 1964.

2526. Cooley, J. H. SITE REQUIREMENTS AND YIELD OF PAPER BIRCH IN NORTHERN WISCONSIN. Lake State Expt. Sta., Sta. Paper 105, 11 pp. 1962. 1.9622 L2St2

Paper birch in northern Wisconsin was studied to provide forest managers in the area with information on yield and site requirements. Site characteristics and the age and total height of dominant and codominant trees were recorded on 103 plots. Stand tallies were made on 71 plots, 54 of which were fully stocked with paper birch.

Terrain was one of the principal determinants of site quality of paper birch in the area. The silt-plus-clay content in the first 6 inches of soil and surface drainage also had a major influence on paper birch growth.

2527. Cooper, W. C., Peynalo, A., and Olson, E. O. RESPONSE OF GRAPEFRUIT ON TWO ROOTSTOCKS TO CALCIUM ADDITIONS TO HIGH-SODIUM, BORON-CONTAMINATED, AND SALINE IRRIGATION WATER. Soil Sci. 86: 180-189. 1958. 56.8 So3

Young Webb Red Blush grapefruit trees on sour orange and Cleopatra mandarin rootstocks were irrigated for a 4-year period with a saline high-Na water contaminated with B to which were added known levels of calcium nitrate, calcium sulfate, or ammonium nitrate. Observations were made on growth and B and salt toxicity, and chemical analyses were made of the leaves and roots for contents of Na, K, Ca, Mg, chloride, sulfate, N, and B.

2528. Dargie, G. DRAINAGE FOR IMPROVED FORAGE PRODUCTION. Brit. Columbia Agron. Assoc. Conf. Rpt. 1957: 82-84. 1957. 29 B772

The value of drainage for improved forage production in Canada was given. A combination of treatments: Tiling; sub-soiling; liming; and deep rooted crops was recommended to obtain good drainage.

2529. Davis, G. H. MANAGEMENT OF WATER IN ARID LANDS: TECHNOLOGY ALONE CANNOT SOLVE PROBLEMS. Nat. Hist. 73(7): 26-33. map. Aug./Sept. 1964. 500 N483J

A report was given on some problems of management of irrigated areas in arid land regions.

2530. Davis, J. F., and Engberg, C. A. A PRELIMINARY REPORT OF INVESTIGATIONS OF SUBSIDENCE OF ORGANIC SOILS IN MICHIGAN. Mich. Agr. Expt. Sta. Q. B. 37: 498-505. 1955. 100 M58S

A study was started in 1948 to correlate subsidence with height of water table, pH, cropping practices, and other physical characteristics and conditions on peat and muck soils in Michigan.

Changes in surface elevation of three organic soil types, Carlisle muck, Houghton muck, and Rifle peat, at 13 sites were studied for 5 years. The range of subsidence was from 0.0 to 0.7 foot.

No correlation between subsidence and soil type was observed. No subsidence was measured at a site where a green-manure crop of rye was grown annually for 4 out of 6 years and 15 to 20 tons of manure applied for 2 years.

2531. De, P. K., and Mandal, L. N. PHYSIOLOGICAL DISEASES OF RICE. Soil Sci. 84: 367-376. 1957. 56.8 So3

Rice plants were grown in waterlogged soils maintained under an atmosphere of (a) air and (b) nitrogen, with and without the addition of ferrous sulfate or sulfuretted hydrogen solution. As indicated by yield and external appearance, the plant growth was normal and healthy, and no disease symptom appeared in any treatment. Periodic analysis of drainage water showed: (1) Disappearance of dissolved oxygen after 21 days from soil kept under nitrogen; (2) presence of large amounts of soluble ferrous iron in soil kept under nitrogen and treated with ferrous sulfate solution; and (3) absence of sulfuretted hydrogen or any soluble sulfide in soil kept under nitrogen and treated with sulfuretted hydrogen solution. The results further showed that drainage water from soils kept under air contained more dissolved oxygen, ferric and ferrous iron, manganese, and total oxidizable matter than that from soils kept under nitrogen.

2532. Dewey, D. R. SALT TOLERANCE OF TWENTY-FIVE STRAINS OF AGROPYRON. Agron. J. 52: 631-635. 1960. 4 Am34P

A study was reported of the salt tolerance of 25 strains representing 14 species of Agropyron grown in artificially salinized field basins and in laboratory germination tests. Four salinity levels, 0, 6,000, 12,000, and 18,000 p.p.m. of a mixture of NaCl and $CaCl_2$ were applied in the irrigation water.

2533. Dewey, D. R. GERMINATION OF CRESTED WHEATGRASS IN SALINIZED SOIL. Agron. J. 54: 353-355. 1962. 4 Am34P

Four strains of standard crested wheatgrass were germinated under laboratory conditions in soil brought to field capacity with water containing 0, 6,000, 12,000, and 18,000 p.p.m. of added salt. Percent germination was decreased, and germination time was increased on a strongly linear scale as salinity was increased from 0 to 18,000 p.p.m. Strains differed in their ability to germinate in salinized soil, and these differences became more pronounced as the salinity level was increased.

Sixteen progenies derived from four crested wheatgrass strains selected at four salinity levels were evaluated in germination trials similar to those applied to the parent strains. Progenies previously selected under conditions of high salinity produced seed that was more tolerant to salinity than was the seed from progenies selected under nonsaline conditions.

2534. Dokoshi, J., and Maeda, T. STUDIES ON THE EVAPO-TRANSPIRATION. I. ON THE PHENOMENA OBSERVED IN THE DRAINAGE OF PEAT BOG. (Ja) Soc. Agr. Met. Japan J. Agr. Met. 15(1): 21-24. June 1959. 340.9 So1
English summary.

A report was given on the discharge of water from a peat bog. A discharge curve was obtained along with periodical changes in drainage due to evapotranspiration.

2535. Doneen, L. D. STUDIES ON WATER QUALITY CRITERIA. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 46-56. Jan. 1958. 55.9 C7693

The utilization of variuos irrigation waters indicated that the standards, or classifications, suggested for judging water quality fail to meet all conditions encountered in the field. This appeared to be particularly significant for waters containing the bicarbonate ion. Chimonides (1958) working with bicarbonate waters, showed that the SAR is not a good value for estimating exchangeable sodium and its influence on infiltration. This is also indicated by the experiments reported in this paper. He also indicated that "effective salinity" should be extended to include all the bicarbonate ions. The sodium exchanges with calcium of the clay, which in turn precipitates as the insoluble calcium carbonate. Thus, as the soil solution concentrates it loses sodium to the exchange complex, and calcium by precipitation, which prevents salines from forming in the soil in proportion to the amount occurring in the irrigation water. The increase of exchangeable sodium, even though small, from the precipitation of calcium can have a marked influence on infiltration.

2536. Doneen, L. D., and Henderson, D. W. QUALITY OF IRRIGATION WATER AND CHEMICAL AND PHYSICAL PROPERTIES OF SOIL. Internatl. Cong. Soil Sci. Trans. 7(I): 516-522. 1960. 56.09 In847T

Most irrigation waters are classified by the amount of total salts present and the sodium percentage or the sodium-absorption-ratio. This may be good criteria when the water consists mostly of chloride salts and they are not allowed to accumulate in the soil. But under irrigation practice the soil solution is frequently many times more concentrated than the irrigation water. The bicarbonates of the water should not be included as a part of the total salts producing salines. This precipitation may be beneficial in reducing the total salines of the irrigation water when the calcium and magnesium content is high, but if the bicarbonates and sodium are high precipitation will increase the exchangeable sodium, cause soil dispersal and aggravate the problems of leaching and tillage of the soil.

2537. Donnan, W. W. DRAINAGE AND WATER MANAGEMENT RESEARCH IN WESTERN EUROPE. J. Irrig. and Drain. Div., ASCE 86(IR 2, 2527): 21-27. June 1960. 290.9 Am3Ps

A report was given on some drainage and water management research in Great Britian, Denmark, and the Netherlands.

2538. Dregne, H. E. EFFECTS OF VARIOUS SALTS ON BARLEY GROWTH. N. Mex. Agr. Expt. Sta. Res. Rpt. 62, 6 pp. 1962. 100 N465R

Because excess soluble salt reduces plant growth, soil salinity is one of the principal threats to a permanent irrigated agriculture. Traditionally, controlling the salt problem has consisted of attempts to completely remove the salt from the soil by leaching water. This is the best thing to do when it is economically feasible, but many times it is not economical. The alternatives are to either abandon the land, accept poor yields, or try to adapt soil and water management practices to the salty condition. The latter approach is being studied at New Mexico and the experiment reported here was designed to throw some light on two phases of the problem: (1) Can fertilizers help reduce the severity of salt effects; and (2) how do some of the common salts affect barley growth and soil properties?

2539. Ducharme, E. P. SUB-SOIL DRAINAGE AS A FACTOR IN THE SPREAD OF THE BURROWING NEMATODE (RADOPHOLUS SIMILIS). Fla. State Hort. Soc. Proc. 68: 29-31. 1955. 81 F66

A report was given on the effect of subsoil drainage on the spread of the burrowing nematode in Florida.

2540. Edwards, F. E. LAND DRAINAGE AND ITS INFLUENCE ON MECHANIZATION. (Abs.) Assoc. South Agr. Workers Proc. 55: 48. 1958. 4 C82

The influence of land drainage on mechanization was discussed. Corn production averaged 23.4 bushels per acre more on a bottom land soil where diversion ditches and open ditches were used than where only natural row crop drainage was used.

2541. Ehlig, C. F. EFFECTS OF SALINITY ON FOUR VARIETIES OF TABLE GRAPES GROWN IN SAND CULTURE. Amer. Soc. Hort. Sci. 76: 323-331. 1960. 81 So12

Black Rose, Cardinal, Perlette, and Thompson Seedless varieties of grapes were grown in sand culture with a nutrient solution to which was added 1-atm. mixed chlorides, 2-atm. mixed chlorides, 2-atm. $CaCl_2$, 2-atm. Na_2SO_4, or no salt. Chloride accumulation from high chloride treatments caused burn on leaf blades of all varieties. Injury developed very rapidly at temperatures above 100° F., but very slowly at temperatures below 90° F. Treatments containing large amounts of calcium in addition to chloride were much more injurious than the NaCl treatment. Black Rose and Cardinal were much more sensitive to chloride than Perlette and Thompson Seedless because they accumulated chloride two to three times faster.

2542. Ehlig, C. F. SALT TOLERANCE OF RASPBERRY, BOYSENBERRY, AND BLACKBERRY. Amer. Soc. Hort. Sci. Proc. 85: 318-324. 1964. 81 So12

A report was given on the salt tolerance of raspberries, boysenberries, and blackberries.

2543. Ehlig, C. F., and Bernstein, L. SALT TOLERANCE OF STRAWBERRIES. Amer. Soc. Hort. Sci. Proc. 72: 198-206. 1958. 81 So12

Strawberries were extremely sensitive to salinity in sand culture and artificially salinized field plots. The osmotic pressure of the nutrient solution was the predominant factor in determining growth of Lassen and Shasta varieties of strawberries in sand culture. High concentrations of chloride in the substrate caused marginal burn on mature leaves. Sodium also produced some marginal burn, but accumulated much more slowly in the leaves than did chloride. Shasta accumulated more chloride and sodium than Lassen and exhibited more severe burn symptoms.

Yields of marketable fruit were decreased by 50 percent when the conductivity of the saturation extracts from soil beneath the plant row was 2.3 mmhos. for Shasta and 2.6 mmhos. for Lassen. Beds six inches in height caused greater chloride injury and reductions in yield than did three-inch beds.

2544. Ehrler, W. SOME EFFECTS OF SALINITY ON RICE. Bot. Gaz. 122(2): 102-104. Dec. 1960.
450 B652

Salinity added to a base-nutrient solution depressed both vegetative growth and grain yield of Caloro rice in accordance with the increase in osmotic pressure of the series: base nutrient; base nutrient plus 1 atm. of salt; and base nutrient plus 2 atm. of salt.

A higher osmotic pressure depressed relative grain yield much more than vegetative growth.

The composition of the added salt (NaCl, $CaCl_2$, or Na_2So_4) had no specific effect on growth or yield.

Chloride salts were not specifically inhibitory to rice.

2545. Eichberger, W. G. ECONOMIC EVALUATION OF DRAINAGE BENEFITS. Diss. Abs. 20(3): 912.
1959. 241.8 M58

An abstract was given of an economic evaluation by linear programming of drainage benefits in Iowa.

2546. Eisen, I. EFFECT OF CULTIVATION ON THE PROPERTIES OF A LOWLAND PEAT-BOG SOIL. (Es)
Eesti Maaviljeluse ja Maaparanduse Teadusliku Uurimise Inst. Teaduslik-Teh. Inform. B.
6: 34-47. 1961. 20 Ee73
Russian summary.

2547. Eizen, I. A. INFLUENCE OF THE AGRICULTURAL UTILIZATION OF LOWLAND BOGS ON THE PROPERTIES
OF PEAT SOILS UNDER CONDITIONS OF THE ESTONIAN SSR. (Rus) Pochvovedenie. 1961(8):
26-33. Aug. 1961. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 8: 840-845. Aug. 1961. 57.8 P34Ae

A report was given on the effect of drainage and cultivation of lowlands peat bogs in Estonia SSR.

2548. Ellingbo, M. THE DRY SUMMER, DITCHING AND DEEP TILLAGE. (No) Norsk Landbr. 12: 380-381,
384. June 3, 1960. 11 N8122

2549. Elpat'evskii, M. P. METHODS FOR MEASURING THE EFFECTIVENESS OF FOREST DRAINAGE. (Rus)
Leningrad. Nauch. -Issled. Inst. Lesn. Khoz. Sborn. Rabot po Lesn. Khoz. 4: 134-154.
Ref. 1961. 99.9 L545

2550. Eriksson, R. USEFULNESS AND RELIABILITY OF DRAIN RECORDS. (Sw) Skogen [Stockholm.]
46(23): 477, 484-485. Nov. 27, 1959. 99.8 Sk51

2551. Eriksson, S. PRODUCTION IMPROVEMENT. (Sw) Grundforbattring. 11(1): 26-33. 1958.
54.8 G92

2552. Eringis, K. I. THE LONGEVITY OF PERENNIAL GRASSES GROWN ON DRAINED PEAT BOGS OF LITHUANIA.
(Rus) Akad. Nauk SSSR. Bot. Inst. Trudy Ser. 6. Introd. Rast. i Zelenoe Stroitel'stvo.
7: 204-206. 1959. 451 Ak15

2553. Ezernack, F. J. RANGE AND WILDLIFE IMPROVED. Soil Conserv. 21: 204-207. Apr. 1956.
1.6 So3S

Staggered borrow pits along cattle walkways and roads increased the value of the range and improved wildlife habitat on gulf coast marshes. These staggered borrow pits did not give the drainage effect of an open ditch and it allowed 2.5 acres of open water for each mile of walkway constructed.

2554. Fanning, C. D., and Lyles, L. SALT CONCENTRATION OF RAINFALL AND SHALLOW GROUNDWATER
ACROSS THE LOWER RIO GRANDE VALLEY. J. Geophysical Res. 69(4): 599-604. Ref. Feb. 15,
1964. 470 J823

A one-year study was made of the salt concentrations of rainfall and the static water table across the lower Rio Grande Valley of Texas. A linear decrease in salt concentration was observed with logarithmic distance inland. The concentrations of individual ions determined, except calcium, followed the logarithmic relationship. The salt content of the shallow, saline ground water also decreased with distance inland. The decline in ground water salt concentration with distance inland was more rapid than the decline in annual salt deposition by rainfall.

2555. Fireman, M. SALT ABSORPTION BY PLANTS FROM SPRINKLER IRRIGATION. Conf. Quality Water
for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 182-185. Jan. 1958.
55.9 C7693

Field and laboratory information obtained thus far indicates that citrus leaves wetted by intermittent sprinklers can absorb sufficient Na and Cl during a single irrigation season to cause serious leaf burn and defoliation. This same evidence does not indicate that Ca, Mg, or SO_4 are absorbed. In several orchards where citrus leaf burn was noted, the same irrigation waters have been applied in furrows for twenty years or more without excessive salt accumulations in the soil or excessive Na or Cl accumulation in the leaves.

In orchards where leaf damage occurred from sprinkling, the total soluble salts in the irrigation water ranged from 491 to 903 p.p.m. The Na content of these irrigation waters ranged from 69 to 190 p.p.m., and the Cl content ranged from 36 to 131 p.p.m.

2556. Fireman, M., and Hayward, H. E. IRRIGATION WATER AND SALINE AND ALKALI SOILS. U.S. Dept. Agr., Agr. Ybk. 1955: 321-327. 1955. 1 Ag84Y

A report was given on the use of irrigation water of good and poor quality. Because of the potential salinity problem when saline irrigation waters are used, leaching and drainage must be provided to remove dissolved salts that would otherwise accumulate in the root zone or in the subsoil immediately below. Inadequate drainage is associated with and contributes to the severity of saline and alkali conditions.

2557. Fireman, M., and Hayward, H. E. IRRIGATION WATER AND SALINE AND ALKALI SOILS. Australas. Irrig. 2(10): 28-29, 31-34. Sept. 1957. 55.8 Au7

The effect of irrigation water on saline and alkali soils in Australia was discussed. The need for good drainage in the area was stressed.

2558. Flodkvist, H. LOWERING OF LAKE HJALMAREN AND ITS CONSEQUENCES. (Sw) Grundforbattring. 8: 251-257. 1955. 54.8 G92
English summary, pp. 286-287.

A report was given on draining Lake Hjalmaren in Sweden. The organic soils settled and damaged the crops. Diking was used to keep water out of the lake.

2559. Fojtik, S. FARMING ON DRAINED AND IRRIGATED FIELDS. (Cz) Pol'nohospodarstvo. 9(7): 545-550. 1962. 19.5 P752

2560. Fonseca, V. F. Da. FIXATION OF RURAL POPULATIONS IN "MACHONOGO" ZONES. (Por) Mozambique. Dir. de Agr. e Florestas. An. 1960: 171-177. 1961. 24 M873

2561. Ford, H. W., and Smith, O. E. CERTAIN PROBLEMS ENCOUNTERED IN PRODUCTION OF CITRUS ON ACID FLATWOOD SANDS. Citrus Mag. 22(6): 20, 24. Feb. 1960. 80 C498

A report was given on drainage problems and practices for citrus production on acid flatwood sands in Florida.

2562. Fox, R. L., and Lipps, R. C. SUBIRRIGATION AND PLANT NUTRITION. I. ALFALFA ROOT DISTRIBUTION AND SOIL PROPERTIES. Soil Sci. Soc. Amer. Proc. 19: 468-473. 1955. 56.9 So3

Root systems of subirrigated alfalfa plants and some associated soil properties were studied. Under certain conditions a concentration of fibrous roots occurred in saturated soil above and below the water table. Roots occurred in abundance in pockets of fine sand and silt while adjacent pockets of moist sand and gravel were essentially devoid of roots.

Nodules occurred in abundance in the A horizon of a buried soil while the surface soil, which was more acid, contained roots without nodules and with only limited branching. Alfalfa roots penetrated soil horizons which contained much Na. They branched extensively in a region of high Na where Ca and Mg were present in abundance.

2563. Francois, L. E., and Bernstein, L. SALT TOLERANCE OF SAFFLOWER. Agron. J. 56(1): 38-40. 1964. 4 Am34P

Four safflower varieties (N-10, U.S. 10, Gila, and 41191197) were grown in artifically salinized plots to determine the effects of saline conditions on the yield and quality of seed produced.

Safflower is highly salt-tolerant. An EC_e of 7 millimhos per centimeter reduced yield by 20 to 25 percent. These yield reductions were caused by a decrease in the number of flowering heads and the yield of seed per head, the latter factor being affected by seed weight and not be seed number.

Safflower appeared to be only half as salt-tolerant during germination as during later stages of growth. An EC_e of 7 millimhos per centimeter doubled emergence time, whereas an EC_e of 14 or 15 millimhos per centimeter was estimated to reduce growth and seed yield by 50 percent.

2564. Francois, L. E., Yermanos, D. M., and Bernstein, L. SALT TOLERANCE OF SAFFLOWER. Calif. Agr. 18(9): 12-14. July 1964. 100 C12Cag

Safflower is highly salt tolerant, according to results of field plot experiments in 1962 and 1963. However, safflower appeared to be only about half as salt tolerant during germination as during later stages of growth. Salinity decreased the oil percentage of the seed, but oil quality was unaffected.

2565. Frohlich, H. SOIL FERTILITY AND WATER SUPPLY. (Ge) Deut. Gartbau. 10(2): 45-46. Ref. Feb. 1963. 80 G1948

2566. Gailledreau, C. EFFECT OF DRAINAGE ON THE CONTAMINATION LEVEL OF SOILS IRRIGATED WITH STRONTIUM 90 POLLUTED WATER. (Fr) Acad. d'Agr. de France. Compt. Rend. 47(4): 171-175. 1961. 14 P215Bc

2567. Gallatin, M. H. UTILIZATION OF BRACKISH WATER FOR IRRIGATION OF GREEN BEANS AND POTATOES. The Vegetable Growers News, 12(1): 1-4. July 1957. 275.28 V52

Potatoes: Results with brackish water irrigation showed a noticeable reduction in yield with increasing salt concentration when irrigated at 0.5 atm. tension (the moist plots), but not when irrigated at 4.0 atm. (the dry plots).

The Irish potato, which is considered a medium salt-tolerant crop, apparently is affected by increasing concentrations of salt in irrigation water.

Leaf burn and breakdown were not apparent in the plots until just before harvest or two weeks after completing irrigation. The burn was more or less proportional to the salt concentration of water applied.

Green Beans: The data showed increasing reduction in yield due to increasing salt concentration regardless of method, amount, or frequency or irrigation. The yield was higher in those plots receiving overhead irrigation than in plots receiving surface irrigation. For the most part, the one-inch application was more satisfactory than the two-inch.

Irrigation with brackish water applied when the soil moisture tension reached 4.0 atm. (dry plots) produced significantly greater yields than plots irrigated at 0.5 atm. (moist plots).

2568. Gallatin, M. H., and Lunin, J. BRACKISH WATER FOR IRRIGATING SNAP BEANS. Peninsula Hort. Sci. Soc. Proc. 49(5): 7-11. 1959.

Many factors must be considered when contemplating the use of brackish water for irrigation. Crops vary in their sensitivity to salinity, and frequently differences occur among varieties of a given crop. Coarse-textured (sandy) soils are less likely to accumulate salts than fine-textured soil (clays) because greater leaching occurs during winter months. Salt injury is also affected by climatic conditions. The stage of growth at which saline water is applied, as well as the salt concentration of the water, will determine the degree of injury. The study indicated that salt injury was governed by the salt content of the soil. Therefore, factors affecting salt accumulating, such as internal drainage, soil texture, etc. must be taken into consideration. Another factor governing salt accumulation was the method of application. Sprinkler irrigation distributed the salt uniformly over the surface of the soil. In furrow-type irrigation the saline water was localized in the furrows and, because of lateral moisture movement and evaporation, resulted in an accumulation on the ridge. High rates of fertilizer application also contributed to soil salinity. The salt concentration of the soil solution was the dominant factor in determining salt injury rather than the salt concentration of the water applied.

2569. Gallatin, M. H., Lunin, J., and Batchelder, A. R. BRACKISH WATER IRRIGATION OF SEVERAL VEGETABLE CROPS IN HUMID REGIONS. Agron. J. 55: 383-386. 1963. 4 Am34P

Use of brackish water for irrigation of vegetable crops was investigated on replicated field plots from 1956-61. It was indicated that many factors determined the results obtained when using brackish water for irrigation of vegetable crops.

The level of soil salinity varied throughout the growing season. The resultant effect of saline irrigation on yields was governed by two major factors: (1) The degree of salt accumulation in the soil as affected by the salt concentration of the water applied, the number of irrigations applied, and the rainfall distribution throughout the year; and (2) the salt tolerance of the specific crop with particular emphasis on the stage of growth during which high salinity levels were attained in the soil. Climatic conditions other than rainfall may have been a factor.

2570. Gamble, M. D., and Rhoades, E. D. EFFECT OF SHORELINE FLUCTUATIONS ON GRASSES ASSOCIATED WITH UPSTREAM FLOOD PREVENTION AND WATERSHED PROTECTION. Agron. J. 56(1): 21-23. 1964. 4 Am34P

Knowledge of inundation tolerance of range and pasture grasses in the Southern Great Plains permits the development of criteria for establishing and managing grasses in the temporary impoundment basins of floodwater-retarding structures.

Many factors, such as duration and depth of submergence, season, and frequency of flooding were associated with satisfactory survival of grasses when inundated. The grasses showed variable tolerance to inundation associated with shoreline fluctuations. Classification of inundation tolerance during the spring months for selected range and pasture grasses were given.

2571. Gariugin, G. A. SPRING DRAINAGE IN RELATION TO THE CONDITION OF SOIL SURFACE. (Rus) Met. i Gidrologiia. 3: 40-42. May/June 1955. 345 M56

2572. Garkusha, I. F. EFFECT OF RECLAMATION ON CHANGE OF MARSHY SOILS. (Rus) Belorusskaia Sel'skokhoz. Akad. Trudy. 20: 14-27. Ref. 1954. 106 B415

2573. Gerard, C. J., Burleson, C. A., Bloodworth, M. E., Cowley, W. R., and Biggar, J. W. EFFECT OF IRRIGATION WATER QUALITY AND SOIL AMENDMENTS ON CROP YIELDS AND PHYSICO-CHEMICAL PROPERTIES OF THE SOIL. Tex. Agr. Expt. Sta. MP-441, 17 pp. 1960. 100 T31M

An experiment was initiated in October 1954 at Weslaco, Tex., to study the effects of water quality and amendment treatments on yields of cotton and vegetables over a 4-year period.

Yield data indicated that poor quality water with good management could be used to supplement low supplies of good quality water on soils such as Willacy fsl. Because poor quality water caused a deterioration of soil structure and usually decreased yields of salt-sensitive crops, water of questionable quality should be used with discretion and caution.

In a rotation of cotton, lettuce, and cabbage, cotton yields were not significantly reduced by poor quality well water, but the lettuce and cabbage yields were significantly reduced.

2574. Ghosh, B. N. DOES PADDY REALLY WANT STANDING WATER? Indian Farming. 9(7): 37, 39. Oct. 1959. 22 In283

A report was given on the effect of different water levels on rice culture in India.

2575. Gilbert, W. B., and Chamblee, D. S. EFFECT OF DEPTH OF WATER TABLE ON YIELD OF LADINO CLOVER, ORCHARDGRASS, AND TALL FESCUE. Agron. J. 51: 547-550. 1959. 1.6 So3S

The effect of depth of water table, with and without surface watering, on shoot yields of Ladino clover, orchardgrass, and tall fescue was studied in the greenhouse, using a Bladen silt loam from the Tidewater area of North Carolina. The water table depths below the soil surface were: 6 inches; 6 inches with aeration at 6 inches; 12 inches; 6 inches for 1 week then 20 inches for 3 weeks; and 20 inches. Two 1/2-inch increments of water were applied weekly to the surface-watered treatments.

All species produced the highest yield when the water table was at 6 inches. Comparison of the 6-inch water tables with the 3 lower ones, showed Ladino clover had a 20 percent higher yield from the 6-inch water tables, while orchardgrass and tall fescue produced 54 and 71 percent more, respectively, from the 6-inch water tables.

The addition of water to the surface resulted in a large increase in yields with orchardgrass and tall fescue grown above the 12-inch, 6- to 20-inch water tables, but a depression in yields above the 6-inch water table. Ladino clover had a significant increase in yield from surface watering at all water table depths.

The root density in the 6- to 12-inch soil layer was greatly reduced by the 6- to 20-inch fluctuating water table as compared to the stable 20-inch table.

2576. Gingrich, J. R., and Russell, M. B. EFFECT OF SOIL MOISTURE TENSION AND OXYGEN CONCENTRATION ON THE GROWTH OF CORN ROOTS. Agron. J. 48: 517-520. 1956. 4 Am34P

Increases in soil moisture tension from 1 through 12 atmospheres brought about progressively smaller increases in radicle elongation, fresh weight, dry weight, and degree of seedling hydration. Growth properties were most sensitive in the range between 1 and 3 atmospheres. At low moisture stress, oxygen concentration of the root atmosphere needed to be above 10.5 percent for maximum growth.

2577. Glinski, J., and Dobrzanski, B. CHANGES IN THE STRUCTURE AND PROPERTIES OF MOUNTAIN SOILS UNDER THE INFLUENCE OF TERRACING. Internatl. Cong. Soil Sci. Trans. 8(1): 577-583. 1960. 56.09 In847T

Terracing of slopes situated in mountainous regions produces changes in the morphological make-up and properties of mountain soils.

These changes concern mainly the thickness of the profile and especially of the humus layer and the humus content in the soil.

The soils of terraced slopes are less acid than those of non-terraced slopes.

Owing to a decrease of the inclination of slopes by about a half and to an increase of the thickness of the soil profile, terracing has a positive influence on the retention of water.

2578. Gorlinski, J. S. SURFACE-WATER QUALITY AND POLLUTION. Conf. Quality Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 107-108. Jan. 1958. 55.9 C7693

Water quality is not a static condition. It tends, in the natural state, to deteriorate progressively downstream, as the water circulates on its great cycle from the land back to the sea. This inherent water-quality deterioration may be considered as "natural pollution." This "natural pollution" is a beneficial process. It imparts to water qualities that enable it to: (1) Sustain life in all its forms; (2) build soil; (3) rearrange the rocks; and (4) create the beauty of the landscape.

In dealing with water-quality degradation we must keep in mind the essential differences between pollution caused by inorganic and organic materials. Inorganic pollution may be derived from the end products retained from the decomposition of organic matter in the streams. Or, it may be acquired as the result of the disposal of manmade wastes containing inorganic salts, minerals, or other chemicals. Dissolved inorganic materials become an integral part of the water itself, imparting definite chemical characteristics to it—alkalinity, hardness, and salinity for example. Suspended inorganic matter, though not an integral part of the water itself, imparts certain physical characteristics to water, such as turbidity and color. Inorganic materials in water remain unchanged except for concentration.

2579. Gorskii, A. I. FARMING ON DRAINED MARSHES OF THE UKRAINIAN SSR. (Rus) Zemledelie. 1961(11): 19-25. Nov. 1961. 20 Z44

2580. Gottlich, K. EIGHT YEARS OF RESEARCH ON THE WATER BALANCE AND STRUCTURAL RELATIONS OF A DRAINED, CULTIVATED LOW MOOR IN THE SOUTHWEST GERMAN ALPINE FORELAND. (Ge) Bayer. Landwirt. Jahrb. 38(6): 718-739. map. Ref. 1961. 18 L24

2581. Gottlich, K., and Babel, U. ON THE EFFECT OF DAMMING UP DITCHES AND DRAINAGE IN FEN AND HALF BOG SOILS. (Ge) Mitt. F. Landkult. Mooru. Torfwirt. 8(2/3): 33-49. June/Sept. 1960. 60.1 M69

2582. Graham, B. F., and Rebuck, A. L. THE EFFECT OF DRAINAGE ON THE ESTABLISHMENT AND GROWTH OF POND PINE (PINUS SEROTINA). Ecology. 39(1): 33-36. Jan. 1958. 410 Ec7

A report was given on the effect of good and poor drainage on the ecological development of contiguous stands of pond pine (Pinus serotina Michx F.) in North Carolina. On the basis of basal area and height, growth of pond pines on the better drained site was nearly double that of the poorly drained site.

2583. Grebennikov, V. N. EFFECTIVENESS OF VARIOUS TYPES OF DRAINAGE IN THE BET-PAK DALA. (Rus) Khlopkovodstvo. 1962(5): 56-59. 1962. 72.8 K522

2584. Grebing, G. GOOD DRAINAGE GIVES BETTER PORTATIVE POWER. (Sw) Gavleborgs Lans Hushsallsk. Lantbrtidskr. 37(4): 105-107. 1961. 11 G24L

2585. Grechin, I. P. EFFECT OF SUPERFLUOUS MOISTURE ON THE SOIL FERTILITY. (Rus) Sel'sk. Khoz. Sev.-Zapadnoi Zony. 1960(11): 63-66. Nov. 1960. 20 Se497

2586. Grunes, D. L., Boawn, L. C., Carlson, C. W., and Viets, F. G., Jr. LAND LEVELING: IT MAY CAUSE ZINC DEFICIENCY. N.Dak. Farm Res. 21(11): 4-7. 1961. 100 N813B

Where surface soil was removed to aid gravity irrigation, severe zinc deficiency of corn and mild zinc deficiency of potatoes were observed. The acid soluble zinc in the exposed subsoils was low. Plant tissues sampled from the zinc deficient areas were also low in zinc.

Zinc sulfate applied either to the soil, or as a spray on the plants, cured the zinc deficiency. Manure (20 tons per acre) was also effective.

2587. Grunig, P. E. THE EFFECT OF DRAINAGE ON SHALLOW MOOR VEGETATION AND ON THE INCREMENT OF SPRUCE (PICEA ABIES) AND OF MOUNTAIN PINE (PINUS MUGO) IN THE FLYSH REGION OF THE FOOTHILLS OF THE ALPS. (Ge) Schweiz. Anst. f. das. Forstl. Versw. Mitt. 31: 421-492. Ref. 1955. 99.9 Sch92

2588. Gruzdev, D. M. EFFECT OF SOIL SALINITY ON GROWTH OF OAK AND OTHER SPECIES UNDER IRRIGATED CONDITIONS IN AZERBAYDZHAN SSR. (Rus) Pochvoveniye. 3: 91-98. Mar. 1959. 57.8 P34
English translation—Soviet Soil Sci. 3: 352-360. Mar. 1959. 57.8 P34Ae

To determine the effect of the degree of soil-salinity on the growth of oak, walnut, persimmon, pine, and European plane tree, and other tree-shrubs, a number of special test plots on strips of forest land and in irrigated zone nurseries were planted; also special pot experiments with various species of oak were conducted. The experiments considered: the care of seedlings, their growth in terms of both height and diameter, quantity of leaves, crown dimensions, dry weight of the seedlings, depth of root penetration into the soil, root structure and distribution, as well as salt content in the leaves, stalks, and tops of the trees under investigation. On each plot, determinations were made of HCO_3, Cl, SO_4 and of solid residue based on the soil horizons.

2589. Gruzis, A. I. EFFECT OF DRAINAGE ON WOOD INCREMENT [IN LATVIA]. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 31: 124-126. 1955. 99.9 Ak1

2590. Guspan, J. COMPLETE AGROTECHNIQUE OF THE DRAINED SOILS. (Cz) Za Vysokou Urodu. 12(1): 25-26. 1964. 64.8 Z12

2591. Haas, R. H., Morton, H. L., and Torell, P. J. INFLUENCE OF SOIL SALINITY AND 2, 4-D TREATMENTS ON ESTABLISHMENT OF DESERT WHEATGRASS AND CONTROL OF HALOGETON AND OTHER ANNUAL WEEDS. J. Range Mangt. 15: 205-210. 1962. 60.18 J82

The effects of soil salinity and the control of annual weeds on the establishment of desert wheatgrass were studied on artifically salinized plots. Four soil salinity levels were created on a medium-textured soil by adding sodium chloride at rates of 0, 20, 40, and 80 pounds per 1.5 square rods before seeding desert wheatgrass. The salinity conditions ranged from non-saline to a salinity level which would permit growth of only salt-tolerant species. The pH of the soil was unchanged at the several levels of salinity.

Halogeton was more tolerant to soil salinity than Russian thistle or desert wheatgrass. Russian thistle was more readily suppressed by competing vegetation than was halogeton.

2592. Hakansson, A. DRAINAGE, SOIL STRUCTURE AND MECHANIZED FARMING. (Sw) (sum.) Forsok och Forsk. 14(12): 130. Dec. 1957. 11 F77

2593. Hall, T. F., and Smith, G. E. EFFECT OF FLOODING ON WOOD PLANTS, WEST SANDY DEWATERING PROJECT, KENTUCKY RESERVOIR. J. Forestry. 53: 281-285. 1955. 99.8

The West Sandy Dewatering Project has operated more or less as an uncleared or partially cleared flood-control reservoir with fixed maximum discharge. Flooding has had an adverse effect on bottomland forests, and much of the timber in the storage basin has been killed. The tolerance of 39 woody species to periodic flooding was determined. All woody species were killed where the root crowns were periodically flooded more than 54 percent of the time during all the growing seasons. These species subjected to less flooding at higher elevations showed varying degrees of tolerance with survival contours stratified over some 12 feet vertically.

2594. Hall, V. L., and Thompson, L. F. SALINITY AND ALKALINITY OF RICE SOILS IN ARKANSAS. Ark. Farm Res. 11(2): 11. Mar./Apr. 1962. 100 Ar42F

A report was given on the effect of salinity and alkalinity on rice soils in Arkansas. The pH of the soil was not a completely reliable indicator of expected plant reaction.

2595. Hallgren, G. DRAINAGE AND CROP INJURIES. (Sw) Lantbretek. Kal. 1962: 57-59, 61-62. 11 L294

2596. Handa, B. K. MODIFIED CLASSIFICATION PROCEDURE FOR RATING IRRIGATION WATERS. Soil Sci. 98(4): 264-269. Ref. Oct. 1964. 56.8 So3

A procedure was given for modification of a classification system for rating irrigation water for salinity and alkalinity hazards and to give an idea of the gypsum requirements of irrigation waters with high sodium hazards.

2597. Hansen, C. J. EFFECTS ON FRUIT TREES OF BORON IN IRRIGATION WATERS. Conf. Quality Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 186-188. Jan. 1958. 55.9 C7693

The chemical element boron is never found uncombined in nature; it is always combined with other elements, such as sodium, oxygen, and hydrogen, to form such compounds as borax ($Na_2B_4O_7 10H_2O$) and boric acid (H_3BO_3).

Most, if not all, plants require boron for normal growth, but injury will result from concentrations much above the minimum small quantities that are necessary. In the majority of cases, injury to fruit trees from boron has resulted from excesses in irrigation water. In some cases, the excess boron has been brought in by flood waters or comes from boron minerals in the soil.

Some fruit trees, such as the lemon, are very sensitive to an excess of boron, whereas the olive is considered semi-tolerant. Deciduous fruit trees, such as peach, apricot, plum, prune, cherry, fig, walnut, apple, pear, and almond, vary in tolerance to excess boron. However, all are considered sensitive.

2598. Harding, R. B. QUALITY OF IRRIGATION WATER IN RELATION TO SALINITY. Calif. Citrog. 47(7): 232, 244-245. May 1962. 80 C125

A discussion was given on the effect of the quality of irrigation water in relation to salinity of the soil for citrus crops in California.

2599. Harding, R. B., Pratt, P. F., and Jones, W. W. CHANGES IN SALINITY, NITROGEN, AND SOIL REACTION IN A DIFFERENTIALLY FERTILIZED IRRIGATED SOIL. Soil Sci. 85: 177-184. 1958. 56.8 So3

Salinity changes in the soil of an irrigated orange orchard during 28 years of differential fertilization were reported.

2600. Harding, R. B., and Ryan, T. M. SOIL SALINITY AND WATER DISTRIBUTION UNDER NONTILLAGE AND TILLAGE IN A DIFFERENTIALLY FERTILIZED, IRRIGATED CITRUS ORCHARD. Proc. Amer. Soc. for Hort. Sci. 77: 155-166. 1961. 81 So12

The influence of nontillage and tillage, various fertilizers, and irrigation water distribution upon the distribution of soluble salts in the soil was studied in long-term citrus fertility trials.

$NaNO_3$ and $(NH_4)_2SO_4$ treatments resulted in the highest amounts of soluble salts in the soil, while $Ca(NO_3)_2$ treatments resulted in less salinity than other fertilized plots, both under nontillage and tillage. Under nontillage, furrows adjacent to tree rows had low amounts of salinity even in treatments receiving $NaNO_3$ or $(NH_4)_2SO_4$. Under tillage, furrows adjacent to the north side of trees were high in salinity while furrows adjacent to the south side of the trees were lower in salinity under the $NaNO_3$ and $(NH_4)_2SO_4$ treatments.

2601. Harris, C. I., Erickson, H. T., Ellis, N. K., and Larson, J. E. WATER-LEVEL CONTROL IN ORGANIC SOIL, AS RELATED TO SUBSIDENCE RATE, CROP YIELD, AND RESPONSE TO NITROGEN. Soil Sci. 94(3): 158-161. Ref. Sept. 1962. 56.8 So3

A report was given on the effect of water level control on organic soils on: Subsidence rate; crop yield; and response to nitrogen.

2602. Harris, W. S. ROW DRAINAGE STUDIES IN THE DELTA AREA. Ark. Farm Res. 9(6): 12. Nov./Dec. 1960. 100 Ar42F

A report was given on row drainage studies in the delta area of Arkansas. The following signs of inadequate drainage were observed: (1) Reduced stand and/or yield; (2) interference with or delay in mechanized farming operations; and (3) excess grass and/or weed growth.

2603. Harrison, D. S., and Weaver, H. A. SOME DRAINAGE CHARACTERISTICS OF A CULTIVATED ORGANIC SOIL IN THE EVERGLADES. Soil and Crop Sci. Soc. Fla. Proc. 18: 184-192. 1958. 56.9 So32

A report was given on some drainage characteristics of a cultivated organic soil in Florida.

2604. Hartmark, H. SETTLING OF MARSHES AS A RESULT OF DRAINAGE. (No) Norske Myrselsk. Medel. 56(4): 105-114. Aug. 1958. 11 N813

2605. Hatt, J. WHAT A DIFFERENCE GOOD DRAINS MAKE. Prac. Power Farming. 21(3): 28-29. Sept. 1958. 58.8 P872

The value of a good subsurface drainage system in England was described and illustrated.

2606. Haugen, O., and Aamodt, H. ORIENTATION ON DRAINAGE AND RECLAMATION TRIALS AT LOMSETER IN NORD-FRON. (No) Vollebekk. Landbrtek. Inst. Stensiltrykk. Ser. C. 21, 14 pp. 1960. 58.9 V88V

2607. Hausenbuiller, R. L., Haque, M. A., and Wahhab, A. SOME EFFECTS OF IRRIGATION WATERS OF DIFFERING QUALITY ON SOIL PROPERTIES. Soil Sci. 90: 357-364. 1960. 56.8 So3

Results were presented for a field study in which analyses of soils from 11 sites were compared with the compositions of waters used to irrigate them. Highly significant correlations were obtained between exchangeable Na in the soil and "residual Na_2CO_3" content, soluble Na percentage, and the Na-adsorption ratios of the waters. No relationship was found between conductivities of the waters and those of the saturation-paste extracts.

2608. Hawkins, J. C. THE EFFECTS OF CULTIVATION ON AERATION, DRAINAGE, AND OTHER SOIL FACTORS IMPORTANT IN PLANT GROWTH. J. Sci. Food and Agr. 13(7): 386-391. Ref. July 1962. 382 So12

A report was given on the effects of cultivation on aeration, drainage, and other soil factors important in plant growth. The effects of drainage on oxygen supply as it affects plant growth were discussed.

2609. Hayashi, M., Hashizume, A., Shinozuka, S., and Igarashi, G. STUDIES ON THE INFLUENCE OF WATER-PERCOLATION IN RICE PLANTS DURING RIPENING PERIOD IN ILL-DRAINED PADDY-FIELD. (Ja) Crop Sci. Soc. Japan Proc. 29(1): 43-46. Ref. Sept. 1960. 22.5 C88 English summary.

A report was given on the effect of drainage on rice plants in Japan during ripening.

2610. Hayes, M. H. B., and Mortensen, J. L. ROLE OF BIOLOGICAL OXIDATION AND ORGANIC MATTER SOLUBILIZATION IN THE SUBSIDENCE OF RIFLE PEAT. Soil Sci. Soc. Amer. Proc. 27: 666-668. 1963. 56.9 So3

Natural profile columns of Rifle peat were obtained by driving asphalt-coated steel cylinders into the soil. The columns were incubated in the laboratory for a 102-day preamendment period. Carbon-14 labeled rye tissue was then mixed with the upper 6 inches of the soil profile and the columns were incubated for an additional 107 days. Irrigation water was applied and CO_2 evolution and organic matter in the drainage water were determined throughout the incubation period.

2611. Hayward, H. E. THE SALINITY FACTOR IN THE REUSE OF WASTE WATERS. Internatl. Arid Lands Mtg. Proc. In THE FUTURE OF ARID LANDS. Amer. Assoc. Adv. Sci. 279-290. 1956. 282.9 W58

The quality of water supplies becomes a more and more critical factor with the increasing need for additional water for irrigation in semi-arid and arid areas. The major characteristics which determine water quality are: Total concentration of soluble salts; concentration of sodium; concentration of bicarbonate; and the occurrence of minor elements such as boron in toxic amounts. The reuse of waters returning to the stream after diversion for irrigation commonly results in a significant increase in total salinity. In some cases, increased concentrations of sodium, chloride, and other elements may affect soil characteristics adversely or may be directly injurious to plant growth.

2612. Hayward, H. E., and Bernstein, L. PLANT-GROWTH RELATIONSHIPS ON SALT-AFFECTED SOILS. Bot. Rev. 24: 584-635. 1958. 450 B6527

A review of the literature (221 article) was given on plant-growth relationships on salt-affected soils. Quantitative information on the salt tolerance of most important crop plants was obtained, and the proximal causes of salt injury, in most cases, was analyzed. Experimental demonstration of the general occurance of osmotic effects and the more restricted development of specific ion effect cleared the way for further advances in understanding the mature of salt injury to plants. When water availability is restricted by salinity, all the factors which regulate or influence water absorption and water loss by plants contribute in some way to the resultant which is termed "salt tolerance."

2613. Heafield, T. G., and Ashley, G. D. DETERIORATION OF SEA-FLOODED SOILS IN LINDSEY, LINCOLNSHIRE. N.A.A.S.Q. Rev. 32: 47-50. Summer 1956. 241 G796

A report was given on the effects of sea flooding on soils and drainage systems in Great Britian.

2614. Hebb, E. A. RELATION OF TREE GROWTH TO SITE FACTORS. Tenn. Agr. Expt. Sta. B. 349, 18 pp. 1962. 100 T25S

The productivity of hardwood forest lands on sites in West Tennessee on soils derived from loess overlying coarse Coastal Plain sediments was evaluated.

Growth curves were constructed for individual trees using cores extracted at 4 or 5 well-spaced locations along the stem. From these curves an index of productivity—height at 50 years—was determined for each site. The following measurable factors considered to affect the site complex were recorded: Topographic position, exposure, drainage, slope length, basal area, competition, depth to mottling, soil aeration porosity, and percent silt. Using an electronic computer, the regression of the productivity index on all possible combinations of these factors was determined for each species.

2615. Heikurainen, L. ROOT FORMATION OF PINE STANDS: HEATH-PLANT SOILS AND ITS INFLUENCE BY DRAINAGE. (Fi) Acta Forest Fenn. 65(3), 85 pp. 1957. 99.9 F492
German summary.

2616. Heikurainen, L. EUTHROPHIC PINE BOGS AND THEIR SUITABILITY FOR DRAINING. (Fi) Silva Fenn. 93(2): 1-29. Ref. 1958. 99.9 F497
English summary.

The drainability of eutrophic pine bogs, based upon data on the growth of stumpage, was presented along with variation in the vegetation on eutrophic pine bogs in Finland.

2617. Heikurainen, L. GROWTH OF STUMPAGE IN DRAINED FORESTS IN DIFFERENT PARTS OF FINLAND. (Fi) Metsataloudellinen Aikakauslehti. 6/7: 233-235. map. 1959. 99.9 F49
English summary.

A report was given on the effect of drainage in forests in different parts of Finland.

2618. Heikurainen, L. THE INFLUENCE OF FOREST DRAINAGE ON GROWTH AND REMOVAL IN FINLAND. (Fi) Acta Forest Fenn. 71(8), 71 pp. map. Ref. 1961. 99.9 F492
English summary.

A report was given on the influence of drainage on the growth and possible cut of forests in Finland.

2619. Heikurainen, L. THE REVIVAL OF TREE GROWTH AND THE FIRST IMPROVEMENT FELLING AFTER DRAINAGE. (Fi) Metsataloudellinen Aikakauslehti. 12: 476-479. 1962. 99.9 F49

2620. Heikurainen, L. REACTION OF TREES AND THE FIRST IMPROVEMENT CUTTING AFTER DRAINAGE. (Sw) Skogsbruket. 33(4): 112-116. 1963. 99.8 Sk59

2621. Heikurainen, L. IMPROVEMENT OF FOREST GROWTH ON POORLY DRAINED PEAT SOILS. In Romberger, J. A., and Mikola, P. eds. INTERNATIONAL REVIEW OF FORESTRY RESEARCH. Academic Press. I: 39-113. Ref. 1964. 99.8 In84

A review of the literature was given on the improvement of forest growth on poorly drained peat soils by drainage and management.

2622. Heikurainen, L., and Kuusela, K. REVIVAL OF THE TREE GROWTH AFTER DRAINAGE AND ITS DEPENDENCE ON THE TREE SIZE AND AGE. (Fi) Metsantutkimuslaitos Julkaisuja. 55(8), 14 pp. 1962. 99.9 F493

A report was given on the effect of drainage on tree growth and its dependence on the tree size and age in Finland. Trees greater than 12 m. in height had lost their ability to increase much in growth even with drainage.

2623. Heilman, M. D., and Thomas, J. R. LAND LEVELING CAN ADVERSELY AFFECT SOIL FERTILITY. J. Soil and Water Conserv. 16: 71-72. 1961. 56.8 J822

A tract of Hidalgo sandy clay loam in Texas was leveled in 1957. Half the block was cut to an average depth of 0.5 foot and the other half was filled. This soil is moderately supplied with available nutrients and is very calcareous throughout the profile.

After leveling, three crops of forage sorghum were grown for soil improvement. The first sorghum crop was fertilized with 200 pounds of ammonium sulfate per acre applied to the cut area. Oven-dry forage yield in 1957 was 3,485 pounds per acre less on the cut area than on the fill area in spite of the fertilization of the cut area. The yields for the cut and fill areas were 5,924 and 9,409 pounds per acre, respectively. In 1959 the cut area produced 11,200 pounds per acre of forage whereas the fill area produced 14,020 pounds per acre. The three crops of sorghum did not materially change the productivity differential between the cut and fill but had considerable value as a soil improving crop for forage yields increased with each succeeding green manure crop.

2624. Heimann, H., and Ratner, R. THE CHANGES IN THE COMPOSITION OF THE SOIL ADSORPTION COMPLEX BY IRRIGATION WITH SALINE WATER. Israel Res. Council B. 11A(2): 126-131. Ref. July 1962. 330.9 Is72B

A report was given on the chemical changes of the soil where saline water is used for irrigation in Israel.

2625. Hellberg, A. DRAINAGE OF PASTURES IS AN IMPORTANT PART OF THE FIGHT AGAINST THE LIVER FLUKE. (Sw) Mjolkpropagandan. 36(5): 116-117. 1959. 44.8 M692

2626. Hilde, D. J. SURFACE DRAINAGE IS NECESSARY FOR A SUCCESSFUL BEET CROP. Crystal-ized Facts. 18(3): 39-41. Winter 1964/65. 66.8 C88

A report was given on the need of surface drainage for a successful sugar beet crop in the Red River Valley of North Dakota.

2627. Hjalmarsson, B. ADJUSTMENT OF CROP CULTURE AND DRAINAGE. (Sw) Grundforbattring. 13(2): 78-79. 1960. 54.8 G92

2628. Hobbs, E. H., and Russell, G. C. EFFECT OF METHOD OF IRRIGATION ON THE DISTRIBUTION OF SALTS IN A CHIN LOAM SOIL. Canad. J. Soil Sci. 43: 65-69. 1963. 56.8 C162

Fields of Chin loam soil, one irrigated by sprinkler methods and the other by surface methods, were sampled to a depth of 5 feet. Analysis of the samples showed the soluble salt content of the sprinkled field, at all depths sampled, to be consistently higher than that of the surface-irrigated field.

2629. Hohendorf, E., and Bohr, R. INTRODUCTORY STUDIES ON THE INFLUENCE ON CERTAIN MICRO-CLIMATIC ELEMENTS OF TREES ALONG MELIORATION DITCHES. (Pol) Rocz. Nauk Roln. Ser. F, Melior. i Uzytkow Zielonych. 71-F-2: 487-500. 1956. 20.5 R59
English summary.

A study was reported of the effect of some microclimatic elements of trees growing along drainage ditches in Poland.

2630. Hosner, J. F. RELATIVE TOLERANCE TO COMPLETE INUNDATION OF FOURTEEN BOTTOMLAND TREE SPECIES. Forest Sci. 6: 246-251. 1960. 99.8 F7632

Under the conditions of the test there was considerable variation in the ability of different bottomland species to withstand complete submergence. For the species tested these relative tolerances to complete inundation indicated a definite range from most to least tolerant as follows: Silver maple, buttonbush, boxelder, black willow, cottonwood, green ash, American elm, pin oak, sycamore, red maple, shumard oak, redgum, hackberry, and cherrybark oak.

High water in some bottomland areas exercised a selective killing effect on reproduction and thereby affected the makeup of individual stands. However, many species exhibited a greater or lesser tolerance of flooding than species-site relationships indicated. Water apparently is most likely to become the limiting factor only on sites that are consistently flooded for fairly long periods of time during the growing season, such as true swamps, deep sloughs, and backwater areas.

2631. Hosner, J. F., and Boyce, S. G. TOLERANCE TO WATER SATURATED SOIL OF VARIOUS BOTTOMLAND HARDWOODS. Forest Sci. 8: 180-186. 1962. 99.8 F7632

There are differences in the relative tolerance to saturated soils of seedlings of different bottomland tree species. Shumard oak and cherry bark oak seedlings suffered heavy mortality, but some seedlings of all species survived continuously saturated soil conditions for sixty days. Four species, green ash, pumpkin ash, pin oak, and water tupelo grew significantly taller in saturated soil than in well-aerated soil on the greenhouse bench.

The seedlings can be classified according to tolerance to water saturated soil conditions as follows: Tolerant—green ash, pumpkin ash, water tupelo, and willow; intermediate—eastern cottonwood, boxelder, red maple, silver maple, pin oak, and sycamore; intolerant—Shumard oak, cherrybark oak, American elm, willow oak, sweetgum, hackberry, and sugarberry.

2632. Hsu, C. THE EVOLUTION AND CHANGE OF THE RICE PADDY SOILS OF THE SOUTHERN KIANGSU AREA. (Ch) Acta Pedol. Sinica. 12(1): 63-73. Ref. Mar. 1964. 56.9 Ac8
Russian summary.

2633. Huffaker, A. LAND RECLAIMING PAYS. Sugar Beet. 13(28): 29. Spring 1961. 66.8 Su34B

A report was given on the economics of reducing alkalinity for sugar beets by improving drainage on irrigated farms in Oregon. The use of gypsum to improve leaching of these areas was discussed.

2634. Huikari, O. STUDIES ON THE EFFECT OF DRAINAGE AND ASH FERTILIZATION UPON THE MICROBES OF SOME SWAMPS. (Fi) Finland Metsantutkimuslaitos Julkaisuja. 42(2), 18 pp. Ref. 1955. 99.9 F493
English summary.

The effects of drainage and ash fertilization upon the microbes in both forested and treeless swamps in Finland were discussed. Ash fertilization plus peat burning was of value for all swamps but of particular value to the drained treeless peat swamps.

2635. Huikari, O. ON THE BENEFICIAL AND HARMFUL CONSEQUENCES OF SWAMP FORMATION. (Fi) Metsatietoa. 1957(1): 250-252. 1957. In Metsataloudellinen Aikakauslehti. 1957(7/8): 250-252. 1957. 99.9 F49
English summary.

Beneficial and harmful consequences of swamp formation in Finland were given. About 1/3 of the Finnish land area consisted of bogs. The effects were given of this swamp formation on the regeneration of forests.

2636. Huikari, O. FERTILIZER TRIALS ON DRAINED PEAT SOILS GIVE PROMISING RESULTS. (Sw) Skogsbruket. 31(6): 155-156. 1961. 99.8 Sk59

2637. Ishizuka, Y., and Ogata, S. ON THE DEPTH OF DRAINAGE OF PEAT LAND FOR ITS AGRICULTURAL RECLAMATION. II. THE RELATION OF THE LEVEL OF NITROGEN FERTILIZATION AND OF WATER TABLE TO THE GROWTH OF FORAGE CROPS. (Ja) J. Sci. Soil and Manure. 33(10): 489-521. 1962. 56.8 J27
English abstract—Soil Science and Plant Nutrition. 9(2): 40-41. Mar. 1963. 56.8 So38

Results of model experiments in Japan were given on the relation of the level of nitrogen fertilizer and of depth of water table to the growth of forage crops.

2638. Ishizuka, Y., and Ogata, S. ON THE DEPTH OF DRAINAGE OF PEAT LAND FOR ITS AGRICULTURAL RECLAMATION. III. THE EFFECT OF FLUCTUATION OF WATER TABLE ON THE GROWTH OF FORAGE CROPS AND SOIL PROPERTIES. (Ja) J. Sci. Soil and Manure. 34(6): 191-234. 1963. 56.8 J27
English abstract—Soil Science and Plant Nutrition. 10(1): 40. Jan. 1964. 56.8 So38

Studies were reported on the effects of water table fluctuations on the growth of forage crops and soil properties on peat soils in Japan.

2639. Ishizuka, Y., and Ogata, S. ON THE DEPTH OF DRAINAGE OF PEAT LAND FOR ITS AGRICULTURAL RECLAMATION. IV. THE EFFECT OF DRAINAGE ON THE UTILIZATION OF SOIL AND FERTILIZER NITROGEN BY ITALIAN RYEGRASS. (Ja) J. Sci. Soil and Manure. 35(2): 37-39. Feb. 1964. 56.8 J27
English abstract—Soil Science and Plant Nutrition. 10(4): 44-45. 1964. 56.8 So38

A report was given on the effect of drainage on the utilization of soil and fertilizer nitrogen by Italian ryegrass in Japan.

2640. Ishizuka, Y., Ogata, S., and Sekiya, S. I. ON THE DEPTH OF DRAINAGE OF PEAT LAND FOR ITS AGRICULTURAL RECLAMATION. I. THE RELATION OF THE DEPTH OF WATER TABLE TO THE GROWTH OF FORAGE CROPS. (Ja) J. Sci. Soil and Manure. 33(10): 483-488. 1962. 56.8 J27
English abstract—Soil Science and Plant Nutrition. 9(2): 40. Mar. 1963. 56.8 So38

Results of model experiments in Japan were given on the depth of water table to the growth of forage crops growing on peat soil.

2641. Ivanicka, J. THE INFLUENCE OF DRAINAGE AND IRRIGATION OF SOILS ON THEIR FERTILIZATION AND IMPROVEMENT OF THEIR EFFICIENCY. (Cz) Pol'nohospodarstvo. 7(8): 573-587. Ref. 1960. 19.5 P752
English summary.

A report was given on the need and use of drainage, irrigation, and improved practices of farming to increase yields in Czechoslovakia.

2642. Iyer, T. A. G., Ramadoss, C., and Krishnamoorthy, V. S. SALINE AND ALKALI SOILS AND CROP RESPONSE IN THE AMARAVATHY RESERVOIR PROJECT, AYACUT AREA, COIMBATORE DISTRICT. Madras Agr. J. 49(7): 225-230. July 1962. 22 M262

A report was given on the evaluation of crop response to poorly drained saline and alkali soils in India.

2643. Izergin, A. I., and Shuravilin, A. V. THE EFFECTIVENESS OF DRAINAGE. (Rus) Zemledelie. 10: 31-34. Oct. 1964. 20 Z44

2644. Jacobs, H. S., Dixon, R. M., Lynn, W. C., and Naddih, B. I. IRRIGATION EFFECTS ON KANSAS SOILS. Kans. Agr. Expt. Sta. Tech. B. 134, 94 pp. 1964. 100 K135

A wide range of soil and water properties was encountered in the 36 soils and waters studied. Soil texture ranged from loamy sand to silty clay loam. Mean soil saturation percentage varied from 25.7 to 54.9. Mean exchangeable sodium percentage and electrical conductivity of the saturation extract ranged from 0.14 to 12.91 and from 0.42 to 5.63 mmhos. per cm. at 25° C., respectively. Electrical conductivity of the irrigation waters varied from 0.38 to 4.82 mmhos. per cm. at 25° C.

Gapon's proportionality factor was significantly related to mean soil saturation percentage and to mean surface area.

Soil saturation percentage was significantly related to the change in concentration taking place as irrigation water changes to soil solution.

2645. Jacobs, H. S., Naddih, B. I., and Dixon, R. M. CORRELATIONS BETWEEN CONSTITUENTS IN IRRIGATION WATERS AND IRRIGATED SOILS IN KANSAS. Soil Sci. Soc. Amer. Proc. 25: 404-407. 1961. 56.9 So3

Soil and water from 26 sites from north-central and southwestern Kansas were studied to determine if knowledge of the chemical composition of irrigation water could be used to predict salt and Na accumulation in soil. Samples were collected in the summer of 1958 and 1959.

Mean exchangeable Na percentage in irrigated soils can be predicted with reasonable accuracy from constituents in irrigation water using Gapon's equation, soluble Na percentage, or the Na adsorption ratio as the basis for estimation. Exchangeable Na percentage can be estimated with an accuracy of ± 1.8 at the 0.90 probability level for 25 out of the 26 soils.

2646. Johnson, D. D., and Guenzi, W. D. INFLUENCE OF SALTS ON AMMONIUM OXIDATION AND CARBON DIOXIDE EVOLUTION FROM SOIL. Soil Sci. Soc. Amer. Proc. 27: 663-666. 1963. 56.9 So3

Osmotic tension reduced nitrate production and CO_2 evolution in a linear manner as the salt concentration of the soil increased. Nitrification rate showed the effects of individual salt species with NaCl being the most toxic. There was no evidence to support earlier reports that Na_2SO_4 was highly toxic.

Total microbial activity in the soil as measured by CO_2 evolution was much more tolerant of osmotic stress and shows less definite individual salt effects. Organisms contributiig to CO_2 production showed a greater tolerance to salt than the nitrifiers and evolution was still measurable at 40-bars osmotic tension.

2647. Johnson, L. J., and Jeffries, C. D. THE EFFECT OF DRAINAGE ON THE WEATHERING OF THE CLAY MINERALS IN THE ALLENWOOD CATENA OF PENNSYLVANIA. Soil Sci. Soc. Amer. Proc. 21(5): 539-542. Sept./Oct. 1957. 56.9 So3

The clay minerals from each horizon of a poorly-drained and well drained member of the Allenwood catena were examined by X-ray methods. In both drainage members, the weathering sequence was: mica (illite) → mica intermediate → vermiculite → chlorite-like. Apparently drainage conditions controlled the degree of expression of the weathering sequence of both sorts.

2648. Johnson, W. O. WELL AIR-DRAINED NORTHERN LOCATIONS VS. POORLY WATER AND AIR-DRAINED SOUTHERN LOCATIONS. Citrus Indus. 43(9): 8, 25, 29. Sept. 1962. 80 C49

A report was given on the need of well air drained and water drained soils for Citrus in Florida. Even though both soils are marginal for citrus, the will air-drained northern locations are more frost free than the poorly water and air-drained soils in southern locations.

2649. Jones, P. D. SALT AND HORTICULTURE. Austral. Dried Fruits News. 39(1): 22. Jan./June 1964. 286.83 Au72

A report was given on salt troubles of horticulture crops in Australia. Methods were discussed of irrigation and drainage practices to help decrease salt problems in both soil and irrigation water.

2650. Jongerius, A., and Pons, L. J. SOME MICROMORPHOLOGICAL REMARKS ON THE MOULDING OF PEATS IN THE NETHERLANDS. (Ge) Z. f. Pflanzenernahr. Dudngung, Bodenk. 97(3): 243-255. Ref. June 1962. 384 Z343A
English summary, pp. VIII.

A report was given on the physical ripening and chemico-biological ripening of drained peats in the Netherlands.

2651. Jurimae, A. ON THE DEVELOPEMENT OF THE ROOT SYSTEM IN SPRUCE-WOODS ON DRAINED PEAT SOILS. (Es) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 17: 21-28. 1960. 106 Es83
English summary.

A report was given on the development of the root system of spruce trees on drained peat land in Estonia and these were compared with the roots of aspen, moor birch, and pine growing on the same soil.

2652. Jurimae, A. ON THE EFFICIENCY OF DRAINAGE ON THE GROWTH OF SPRUCE ON DRAINED PEAT SOILS. (Es) Estonskaya Sel'skokhoz. Adad. Sborn. Nauch. Trudov. 29: 104-111. 1963. 106 Es83
English summary.

A report was given on the efficiency of drainage on the growth of spruce growing on drained peat soils in Estonia.

2653. Juusela, T. EFFECT OF DRAINAGE OF THE CARRYING POWER OF ARABLE LAND. (Sw) Nord. Jordbrforsk. 39(1/2): 146-150. 1957. 11 N752
Includes discussion.

2654. Kaddah, M. T. SALINITY EFFECTS ON GROWTH OF RICE AT THE SEEDLING AND INFLORESCENCE STAGES OF DEVELOPMENT. Soil Sci. 96: 105-111. 1963. 56.8 So3

The effects of salinity on germination, and on the seedling and inflorescence stages of growth of rice were reported for three experiments. Interaction of irrigation and drainage frequency with salinity at the latter stage of growth were also given.

2655. Kaddah, M. T., and Ghowail, S. I. SALINITY EFFECTS ON THE GROWTH OF CORN AT DIFFERENT STAGES OF DEVELOPMENT. Agron. J. 56(2): 214-217. 1964. 4 Am34P

A report was given on the results of field and laboratory trials on the effect of salinity on the growth of corn at germination and different steps of growth development.

2656. Kadman, A. THE UPTAKE AND ACCUMULATION OF CHLORIDE IN AVOCADO LEAVES AND THE TOLERANCE OF AVOCADO SEEDLINGS UNDER SALINE CONDITIONS. Proc. Amer. Soc. Hort. Sci. 83: 280-286. 1963. 81 So12

Avocado seedlings of 8 varieties were grown under saline conditions produced by irrigation with water containing 500 p.p.m. Cl as NaCl. The plants were graded for leaf scorches, growth was measured, and leaf samples were taken for analysis every 2 months.

In general, a close correlation was found between Cl content in the leaves and the grade of leaf scorch, except for the Mexican Gl 7 variety. The seedlings of that variety showed the highest Cl content in their leaves and yet their damage rating was among the lowest.

2657. Kaitera, P. ESTIMATION OF LAND SURFACE SETTING IN DRAINAGE. (Sw) Nord. Jordbrforsk. 36: 532-537. Ref. 1954. 11 N752

2658. Kaitera, P. COMMON DIRECTIVES FOR THE INVESTIGATION OF THE SETTLING OF PEAT AND MUCK SOILS IN SCANDINAVIA. (Sw) Nord. Jordbrforsk. 39(1/2): 131-135. 1957. 11 N752
Discussion, pp. 141-145.

2659. Kalnins, A. INCREASED YIELDS OF PINE STANDS GROWN ON PEATY SOILS AS AFFECTED BY DRAINAGE. (La) Jaunakais Mezsaimnieciba. 5: 47-50. Ref. 1963. 99.8 J32
Russian summary.

2660. Kalnyn'sh, A. CHANGES IN THE GRADE STRUCTURE OF PINE STANDS AS A RESULT OF DRAINAGE. (Rus) Latv. PSR Zinatnu Akad. Vest. 8: 113-116. 1962. 511 R442
German summary.

2661. Kamphuis, G. L. THE WATER MANAGEMENT TEST FIELD OF THE EXPERIMENT FARM FOR THE HOLLAND-UTRECHT PASTURE AREA AT ZEGVELD, FOR THE YEARS 1952 TO AND INCLUDING 1954. (Du) Netherlands Rlandbconsschap. v. Noordelijk Zuid-Holland. Verslagen en Meded. 2: 11-14. 1955. 12 N3828

2662. Kannenberg, J. THE CHANGES IN SOIL CONDITIONS OF SMALL POLDERS; WITH SPECIAL REFERENCE TO NITROGEN MANAGEMENT. (Ge) Z. f. Acker-u. Pflanzenbau. 110(1): 82-112. Ref. Feb. 1960. 18 J825
English summary.

A report was given on the physical soil changes due to polding in Germany. Special reference was made to nitrogen management of polders.

2663. Kanwar, J. S. CLAY MINERALS IN SALINE ALKALI SOILS OF THE PUNJAB. J. Indian Soc. Soil Sci. 9(1): 35-40. 1961. 56.9 In2

Clays less than 2 microns separated from four saline-alkali and one saline soil, representative of typical soils of the Punjab, were subjected to X-ray diffraction, differential thermal analysis, glycol adsorption, and chemical analysis. It was observed that the dominant clay mineral in these soils was illite, with some chlorite. There was little difference in the clay mineral composition of saline-alkali and normal soils of the same tract.

2664. Kanwar, J. S., Sehgal, J. L., and Bhumbla, D. R. RELATIONSHIP BETWEEN SOME INDICES OF SALINE-SODIC SOILS. J. Indian Soc. Soil Sci. 11: 39-44. 1963. 56.9 In2

An attempt was made to find the relationship between: (1) The pH of the saturated soil paste and exchangeable sodium plus potassium percentage (E.S. + E.P.) of the soil; (2) pH and soluble carbonate percentage; (3) electrical conductivity (E.C. x 10_3) and total soluble cations in saturation extracts of the soil; and (4) gypsum requirement (G.R.) and exchangeable sodium and potassium content of the saline-sodic soils of Karnal district (Punjab). Simple regression equations between all the above-mentioned four pairs were found. A significant multiple regression between pH, exchangeable sodium and potassium percentage, and soluble carbonate percentage of the saturation extract of the soil was worked out.

2665. Kattan, A. A., and Bryan, B. B. ON NEWLY LEVELED LAND, IRRIGATION AND TWIN SPACING IMPROVED YIELD AND GRADE OF SWEET POTATOES. Ark. Farm Res. 9(6): 8. Nov./Dec. 1960. 100 Ar42F

A report was given on the value of irrigation and twin spacing for sweet potato production on newly leveled land.

2666. Kawaguchi, K., Matsuo, Y., and Waki, K. MOVEMENT OF ACTIVE OXIDES ALONG SOIL PROFILES OF THE ILL-DRAINED DRY PADDY FIELD. VI. STUDIES ON FORMATION OF PADDY SOILS. (Ja) J. Sci. Soil and Manure. 27(6): 233-236. Sept. 1956. 56.8 J27
English summary.

Soil profiles were studied to learn of the distribtuion of active and inactive oxides in a poorly drained dry paddy field in Japan.

2667. Kelley, W. P. SODIUM CARBONATE AND ADSORBED SODIUM IN SEMIARID SOILS. Soil Sci. 94: 1-5. 1962. 56.8 So3

A study was reported of sodium carbonate and adsorbed sodium in semiarid soils.

2668. Kelley, W. P. USE OF SALINE IRRIGATION WATER. Soil Sci. 95: 385-391. 1963. 56.8 So3

A study was reported on the effects of saline irrigation water on crops and soils.

2669. Kelley, W. P., Chapman, H. D., and Pratt, P. F. EFFECT OF PLANT GROWTH ON SALTS OF IRRIGATED SOIL. Soil Sci. 91: 103-112. 1961. 56.8 So3

A report was given on a study of plant growth on salts of irrigated soil in large tanks in California.

2670. Kern, H. PROBLEMS OF MEADOW DRAINING IN WARMIA AND MASURIA. (Pol) Olsztyn. Wyzsza Szkola Roln. Zeszyty Nauk. 12(2): 243-256. 1962. 20.5 OL8
English summary.

A report was given on the problems of draining meadows in Warmia and Masuria in Poland. Some of the research being conducted were reported. The need for additional research was stressed.

2671. Khainla, V. RAISING THE PRODUCTIVITY OF MARSHY FORESTS BY DRAINAGE. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 49: 94-100. 1959. 99.9 Ak1

2672. Khainla, V. INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS BY MEANS OF DRAINAGE. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 97-102. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the use of drainage in Estonia to increase the productivity of swamped forests and expanding the forest areas.

2673. Khainla, V. E. ON INCREASING THE PRODUCTIVITY OF FORESTS ON DRAINED SWAMPS. (Rus) Akad. Nauk Latviiskoi SSR. Inst. Lesokhoz. Prob. Trudy. 22: 127-130. 1961. 99.9 R44

2674. Kido, M., and Yanatori, S. PHYSIOLOGICAL AND ECOLOGICAL STUDIES OF RICE PLANT IN WELL-DRAINED AND ILL-DRAINED FIELDS. VI. CHANGES OF SOME CONSTITUTENTS IN ROOT OF RICE PLANT. (Ja) Crop Sci. Soc. Japan Proc. 29(1): 40-42. Sept. 1960. 22.5 C88
English summary.

A report was given on changes of rice roots in well drained and poorly drained rice fields in Japan.

2675. Kido, M., and Yanatori, S. PHYSIOLOGICAL AND ECOLOGICAL STUDIES OF RICE PLANT IN WELL-DRAINED AND ILL-DRAINED FIELD. VIII. DISTRIBUTION OF SILICIFIED TISSUES OF RICE CULM AND SILICATE CONTENT IN EACH INTERNODE AS AFFECTED BY DIFFERENT CULTURAL CONDITIONS. (Ja) Crop Sci. Soc. Japan Proc. 31(3): 237-240. Ref. Apr. 1963. 22.5 C88
English summary.

A report was given on the effect of drainage on the silicate content of rice plants in Japan.

2676. Kido, M., and Yanatori, S. PHYSIOLOGICAL AND ECOLOGICAL STUDIES OF RICE PLANT IN WELL-DRAINED AND ILL-DRAINED FIELD. IX. CHANGES OF PHOSPHATE AND POTASSIUM CONTENT IN INTERNODE OF RICE PLANT. (Ja) Crop Sci. Soc. Japan Proc. 31(3): 241-244. Ref. Apr. 1963. 22.5 C88

A report was given the effect of drainage on the changes of the phosphate and potassium content of rice plants in Japan.

2677. Kiefer, F. W. DEMONSTRATING THE MANAGEMENT OF POORLY DRAINED SOILS. Farm and Home Sci. [Utah Sta.] 21(3): 76-77, 85. Sept. 1960. 100 Ut1F

A report was given on a demonstration farm in Utah working on land management problems of poorly drained soils.

2678. King, S. M., Kidder, E. H., and Cutler, W. A. METHODS OF DRAINING PICKFORD CLAY AND THE EFFECT ON CROP PRODUCTION; PRELIMINARY REPORT. Mich. Agr. Expt. Sta. Q.B. 42(1): 52-64. Aug. 1959. 100 M58S

A report was given on the effect of different drainage methods on crop production on heavy poorly drained soils in Michigan.

2679. Kinori, B. Z. ECONOMIC EVALUATION OF DRAINAGE AND FLOOD CONTROL IN SEMI-ARID REGIONS. Tel. Aviv, 1963. 23 pp. (Water Planning for Israel, P.N. 264) 1963. 54 K62

An economic evaluation was given of drainage and flood control in semi-arid regions of Israel.

2680. Kira, Y., Shiina, K., and Takenaka, H. ON THE INFLUENCE OF THE PERCOLATION UPON PADDY SOIL AND RICE PLANT. II. (Ja) Agr. Engin. Soc. (Japan) Trans. 1: 7-12. Ref. Oct. 1960. 290.9 Ag8
English summary.

A report was given on the changes of soil properties of paddy soils due to a leaching experiment conducted in Japan.

2681. Kiuchi, T., Chiba, S., and Sato, T. RESEARCHES ON THE HACHIRO-GATA BOTTOM SOIL. I. ON THE CHARACTERISTICS OF THE LAGOON BOTTOM SOIL AND ITS CHANGES DURING DRYING. Soil Sci. and Plant Nutr. 7(1): 18-23. July 1961. 56.8 So38

Research was given on the effect of drainage on the characteristics of some lagoon bottom soils in Japan.

2682. Kollist, P. I. CERTAIN RESULTS OF THE INVESTIGATION OF FOREST REGENERATION CONDITIONS ON DRAINED TRANSITION SWAMPS IN ESTONIAN SSR. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 31: 115-123. Ref. 1955. 99.9 Ak1

2683. Kollist, P. I. VARIOUS DATA ON GROWING CONDITIONS IN FORESTS ON RECLAIMED TRANSITIONAL SWAMPS. In P'yaychenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 18-26. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

Data was given on the differences in growing conditions between drained and undrained soil in peat forest soils in Estonia.

2684. Korhonen, K. H. ON DRAINING OF ALLUVIAL LANDS. (Fi) Suo. 21(1): 1-12. Aug. 8, 1961. 54.8 Su7
English summary.

The problems were given of soil technology occurring in connection with the drying of alluvial lands gained by lowering the water level of lakes in Finland.

2685. Korven, H. C., and Wilcox, J. C. EFFECTS OF FLOW VARIATIONS ON THE SALT CONTENT AND REACTION OF A MOUNTAIN CREEK. Canad. J. Soil Sci. 44(3): 352-359. 1964. 56.8 C162

Water samples were taken and the stream flow measured at intervals during the summer of 1962 at several locations on a mountain stream and its tributaries which are a source of water for domestic and irrigation purposes for Summerland, B.C. Electrical conductivity and pH were determined for each sample and related to flow.

There were highly significant negative correlations between the amount of water flowing past any given point in a stream and both conductivity and pH of the water at that point. Conductivity and pH showed high positive correlations. Considering the main stream on any one date, there was an increase in salt content of the water with a decrease in elevation. Storage reservoirs were beneficial because during the major portion of the irrigation season when storage water was being used, the increased flow meant a water supply of lower salt content and alkalinity than would be the case under normal stream flow.

2686. Kostrzewa, S. RESULTS OF STUDIES ON SHALLOW, WIDELY SPACED DRAINAGE ON ARABLE LAND OF GOROW COUNTY, WROCLAW PROVINCE. (Pol) Wiad. Melior. i Lakarskie. 5(6): 182-184. Nov./Dec. 1962. 54.8 W63

2687. Koyama, T., Miyasaka, A., and Eguchi, K. STUDIES OF THE EFFECT OF VARIOUS TREATMENT OF IRRIGATION AND SURFACE DRAINAGE UPON THE PLANT GROWTH AND SOIL CONDITIONS. (Preliminary report). (Ja) (Abs.) Crop Sci. Soc. Japan Proc. 24: 129. Dec. 1955. 22.5 C88

2688. Koyama, T., Miyasaka, A., and Eguchi, K. STUDIES ON WATER MANAGEMENT IN THE ILL-DRAINED PADDY FIELD. VII. THE EFFECT OF THE SURFACE DRAINAGE ON THE PHOTOSYNTHETIC ACTIVITY IN RICE PLANT. (Ja) Crop Sci. Soc. Japan Proc. 30(2): 143-145. Ref. Jan. 1962. 22.5 C88
English summary.

An investigation in Japan was reported on the effect of drainage of the photosynthetic activity of the rice plant.

2689. Koyama, T., Miyasaka, A., Ito, E., and Eguchi, K. STUDIES ON WATER MANAGEMENT IN THE ILL-DRAINED PADDY FIELD. VI. EFFECTS OF SURFACE DRAINAGE ON TILLERING OF RICE PLANTS. (Ja) Crop Sci. Soc. Japan Proc. 29(1): 37-39. Sept. 1960. 22.5 C88
English summary.

A report was given on the effect of surface drainage on tillering of rice plants in Japan.

2690. Koyama, T., Miyasaka, A., Musya, T., and Ito, E. STUDIES ON WATER MANAGEMENT IN THE ILL-DRAINED PADDY FIELD. IV. THE EFFECT OF SURFACE DRAINAGE TO THE MORPHOLOGY AND STRUCTURE OF RICE ROOTS. (Ja) Crop Sci. Soc. Japan Proc. 27(1): 31-34. Sept. 1958. 22.5 C88
English summary.

The effects of surface drainage on the morphology and structure of rice roots were given for an experiment conducted in Japan.

2691. Koyama, T., Miyasaka, A., Musya, T., Ito, E., and Eguchi, K. STUDIES ON WATER MANAGEMENT IN THE ILL-DRAINED PADDY FIELD. V. THE EFFECT OF SURFACE DRAINAGE ON THE RICE PLANT LODGING. (Ja) Crop Sci. Soc. Japan Proc. 28(1): 58-60. Sept. 1959. 22.5 C88
English summary.

A report was given on the effect of surface drainage on rice plant lodging in Japan.

2692. Kozlovskaya, L. S. ROLE OF SOIL ORGANISMS IN DECOMPOSITION OF ORGANIC REMAINS IN SWAMPED FOREST SOILS. In P'yaychenko, N. L., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 27-39. Ref. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the role of soil organisms in decomposition of organic remains in drained and undrained swamped forests in the U.S.S.R. Specific complexes of soil fauna characterized each given type of forest swamp. Under the influence of drainage, one soil fauna complex may be replaced by another, followed by a change in the type of decomposition of the organic matter.

2693. Krigul, T. RESULTS OF DRAINAGE IN THE EXPERIMENTAL-DEMONSTRATION FOREST OF THE ESTONSKAYA SEL'SKOKHOZYAISTVENNAYA AKADEMIYA. (Es) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 23: 53-71. 1962. 106 Es83
German summary.

2694. Krupkin, P. I. MOVEMENT OF SALT SOLUTIONS IN SOILS AND SOIL MATERIALS. Soviet Soil Sci. 6: 567-574. June 1963. 57.8 P34Ae

Results were given of experiments with monoliths of strongly leached fine-textured chernozems treated for 6 months and 4 years with single- and mixed-salt solutions.

2695. Kubota, S. CHARACTERISTICS OF SOIL OF THE SEA POLDER AND SEQUENTIAL CHANGE OF SOIL TYPE AFTER RECLAMATION. (Ja) Okayama. Agr. Expt. Sta. Spec. B. 59, 300 pp. maps. Ref. Dec. 1961. 107.6 Ok1R
English summary.

A report was given on soil characteristics of a sea polder project in Japan before and after reclamation.

2696. Kuntze, G., and Golisch, K. OVERSALTING OF FLOODED SOILS. (Ge) Mitt. der Deut.-Landwirt.-Gesell. 77(19): 650-653. May 10, 1962. 18 N39

2697. Kupchinov, N. N. EFFECT OF FOREST LAND DRAINAGE ON GROWTH OF PINE AND ALDER [ALMUS] STANDS IN BELORUSSIAN SSR. (Rus) Akad. Nauk. SSSR. Inst. Lesa. Trudy. 31: 99-114. Ref. 1955. 99.9 Ak1

2698. Kushman, L. J., Hoover, M. W., and Haynes, F. L. THE EFFECT OF WET SOIL AND CARBON DIOXIDE ON POTATO CHIP COLOR AND SUGAR CONTENT. Amer. Potato J. 36: 450-456. 1959. 75.8 P842

The data indicated that high soil moisture caused changes in potatoes which influenced the color of chips made from them. The poor color of chips made from potatoes grown under high soil moisture was always apparent after storage at 60° F. and sometimes related to the growing season precipitation.

2699. Kutera, J. DRAINAGE OF SOILS IRRIGATED WITH SEWAGE WATERS. (Pol) Warsaw Inst. Melior. i Uzytkow Zielonych. Wiad. 3(1): 203-208. 1962. 54.9 W262W

2700. Kvarnemo, L. COVERED DRAINAGE DITCHES; AN IMPORTANT FACTOR IN EFFICIENT CROP CULTURE. (Sw) Skaraborgs Lans Hushsallsk. Tidn. 4: 55-56. Aug. 1962. 11 Sk1

2701. Kwinichidze, M., and Marcinek, J. PROBLEMS ON DEGRADATION OF MEADOW SOILS FORMED FROM PEATS IN THE NOTEC RIVER VALLEY. (Pol) Rocz. Nauk Roln. Ser. F, Melior. i Uzytkow Zielonych. 72-F-2: 657-728. Ref. 1957. 20.5 R59
English summary.

The following reasons were given for the degradation of meadow soils formed from peats in Poland: (1) Sudden and excessive drying of the peat bed resulting in far reaching physical, physical-chemical, and chemical changes in peat humus; and (2) slow and partial exploitation of meadow peat soils due to the use of the nutrient elements.

2702. Ladefoged, K. PROTECTION OF PLANT GROWTH AGAINST WATER SHORTAGE THROUGH DRAINAGE. (Da) Hedeselsk. Tidsskr. 82(5): 73-81. Apr. 15, 1961. 11 H35

2703. Lagerwerff, J. V. and Holland, J. P. GROWTH AND MINERAL CONTENT OF CARROTS AND BEANS AS RELATED TO VARYING OSMOTIC AND IONIC-COMPOSITION EFFECTS IN SALINE-SODIC SAND CULTURES. Agron. J. 52, 603-608. 1960. 4 Am34P

The randomized-block experiment involved irrigation of carrots and kidney beans in sand-filled pots with nine different solutions containing variable amounts of NaCl, $CaCl_2$ and $MgCl_2$ so as to give three values of Na-adsorption ratios at three levels of salinities. Statistical analysis of data on the dry and fresh weights and composition of the leaves and stems showed that the tolerance of plants for Na depended on the level of salinity, and tolerance for salinity on the level of Na in the growth medium. There were significant differences in yield and composition and correlations between K and P contents of the plants under the treatments applied.

2704. Lagerwerff, J. V., and Ogata, G. PLANT GROWTH AS A FUNCTION OF INTERACTING ACTIVITIES OF WATER AND IONS UNDER SALINE CONDITIONS. Internatl. Soc. Soil Sci. Cong. Trans. 7(3): 475-480. 1960. 56.09 In847T

Red kidney beans were grown on culture solutions of which the osmotic pressure (OP) was due to a base nutrient plus either an excess of ions, or purified, inert, "Carbowax" polyethylene glycol (molecular weight 15,000—20,000). Different osmotic and ionic composition effects were induced by varying the sodium-adsorption-ratio (SAR) at each of a number of levels of OP. The total weight was found to be functions of both the OP and SAR, underlining the relativity of salt tolerance. The yeld of "Carbowax"-treated plants was significantly greater than that of plants grown on isotonic solutions containing ions only. Extrapolation of data suggests that ionic composition effects started suppressing plant growth independently from osmotic effects at an OP of about 1.7 atm.

2705. Lakovlev, N. I. FOREST CROPS ON DRAINED MARSHES AND FELLING AREAS IN THE TAIGA AREA. (Rus) Lesn. Khoz. 8(5): 48-50. May 1955. 99.8 L5622

2706. Lapitskii, I. I., and Noskova, A. V. INCREASING POTATO YIELDS ON SOILS WITH A TEMPORARY EXCESS OF MOISTURE BY AGRO-MELIORATION. (Rus) In KATOFEL'; PEREDOVOI OPYT I DOSTIZHENIIA NAUKI. Moskva. Gosudarstvennoe Izdatel'stvo Sel'skokhoziaiastvennoi Literatury, pp. 181-192. 1958. 75 K143

2707. Larin, I. V., and Akimtseva, Z. S. CULTIVATION OF SOLONETZ SOILS AND THEIR COMBINATIONS WITH OTHER SOILS FOR FORAGE PLANTS. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 12: 87-91. Dec. 1963. 20 V633
English summary.

A report was given on the cultivation and use of some solonetz soils in the USSR.

2708. Laskowski, S., and Fenglerowa, W. INTRODUCTORY INVESTIGATION ON THE INFLUENCE OF MOLE DRAINING, MOLE TILLAGE, SUBSOILER AND DEEP TILLAGE IN THE HEAVY MADE GROUND OF ZULAWY WISLANE. (Pol) Stettin. Wyzsza Szkola Roln. Zeszyty Nauk. 2: 35-68. Ref. 1959. 20.5 St4
English summary.

A report was given on the influence of mole drainage, mole tillage, subsoiling, and deep tillage on heavy soils in Poland.

2709. Lebedevich, N. F. WATER REGIME IN PEAT AND SWAMP SOILS IN THE BELORUSSIAN SSR AND CROP YIELDS. Jerusalem, Israel Program for Scientic Translations, 60 pp. 1961. 54 L49

A report was given on the water regime of peat and swamp soils in Belorussian SSR and some crop yields.

2710. Lembke, W. D. DRAINAGE-CROP REQUIREMENTS. Internatl. Seminar Soil and Water Util. Proc. 1962: 210-211. 1962. 56.9 In86

A report was given on the effects of drainage on crop growth on irrigated areas.

2711. Lemon, E. WHAT TILE DRAINS ARE DOING FOR ME. Ontario Soil and Crop Impr. Assoc. Addresses and Proc. 1958: 21-22. 1958. 64.9 On83

A report was given on the value of tile drains for a farm in Canada.

2712. Leo, M. W. M. EFFECTS OF CROPPING AND FALLOWING ON SOIL SALINIZATION. Soil Sci. 96(6): 422-427. 1963. 56.8 So3

The nature of water-salt movement in soil under cropped and fallowed conditions as related to soil salinization was studied in soil columns in the greenhouse.

A barley crop reached maturity with 4.2 inches of surface-applied water (artificial rainfall) in addition to a constant ground water supply from about 4 feet below the ground surface. Within the growing season, the average water loss from the columns growing barley was 7.9 inches greater than from the fallowed soil. Water loss decreased with increasing salinity of ground water.

The salt concentration of soil at harvest, as measured by electrical conductivity, was markedly affected by the salt concentration of the ground water and by the root system of the crop. The root system tended to accelerate water-salt movement from deeper soil horizons to the root-zones, while the fallowed soil tended to accumulate salt in the surface soil. Alternate cropping and fallowing facilitated the upward movement of salt from a high ground water table to the soil surface in relays and, therefore, contributed to soil salinization.

2713. Letey, J. AERATION, COMPACTION, AND DRAINAGE. Calif. Turfgrass Cult. 11(3): 17-21. July 1961. 60.18 So8

A discussion was given on the value of aeration, compaction, and drainage for turfgrasses in California. Both surface drainage and subsurface drainage were discussed.

2714. Leushev, A. N. CONTRIBUTION TO THE PROBLEM OF THE EFFECT OF SOME RECLAMATION SYSTEMS ON THE YIELDS OF AGRICULTURAL CROPS. (Rus) Belorusskaya Sel'skokhoz. Akad. Trudy. 30(2): 66-77. 1959. 106 B415

2715. Lewis, G. C. WATER QUALITY STUDY IN THE BOISE VALLEY. Idaho Agr. Expt. Sta. B. 316, 27 pp. 1959. 100 Id1

Approximately one-half of the water sources sampled were of good quality for irrigation usage without dilution. The remainder of the water sources can be used for irrigation if they are mixed with good quality water, and many of them can be used on some soils without dilution. Most of these sources were of poorer quality because of high salt content or high residual sodium carbonate.

Many water sources showed a change in quality during the irrigation season.

If the drainage problem of the Boise Valley can be alleviated by drainage wells, it appears feasible to reuse much of this water for irrigation purposes. This may lower the water table to a desirable depth and at the same time release water for other uses.

2716. Leyton, L., and Yadav, J. S. P. EFFECT OF DRAINAGE ON CERTAIN PHYSICAL PROPERTIES OF A HEAVY CLAY SOIL. J. Soil Sci. 11(2): 305-312. Sept. 1960. 56.8 J823

A report was given on the effect of drainage on some physical properties of a heavy clay soil in England.

2717. Lilleland, O. EFFECTS OF MILD SALINITY ON DECIDUOUS FRUIT TREES. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 189-192. Jan. 1958. 55.9 C7693

Deciduous fruit trees are in general very sensitive to salts in the soil.

Injury to plant growth generally occurs when soils contain from 1,000 to 2,000 pounds of soluble salts per million pounds of soil. Injury from sodium salts can occur in California orchards when the soluble salt content is as low as 300 p.p.m.

A soil-water extract contains principally salts of the following elements: Calcium; magnesium; potassium; and sodium.

Sampling orchard soils in one-foot increments to a depth of eight feet was found desirable in diagnosing salt and alkali injury to fruit trees. In addition to confirming chemically a suspected salt condition, an examination of this type also revealed some of the problems of correction. A study of the physical characteristics of the soil profile is important in any future reclamation. Heavy subsoils, hardpan, and high water tables make correction of a salt area most difficult for orchard trees. On the other hand, sandy subsoils and good subsoil drainage favor leaching of the sodium salts, and a possible correction. The deeper rooting and the marked sensitivity of fruit trees to salts in the subsoil makes a detailed soil study highly desirable.

2718. Lindqvist, R. WATER OR SEED BEDS IN THE SPRING. (Sw) Malmohus Lans Hushallsk. Kvrtlskr. 1: 112-116. 1959. 11 M29

2719. Linehan, P. A., and Lowe, J. CONJOINT EFFECTS OF RESEEDING, FERTILIZATION AND MOLE-DRAINING ON VEGETATION AND OUTPUT OF PERMANENT MEADOWLAND IN COUNTY ANTRIM. North Ireland Min. Agr. Res. and Expt. Rec. 4: 8-15. 1956. 10 N8IR

The combined effects of mole drainage and fertilization of permanent hayland in Ireland was a 60 percent increase in yield for old sward and a reseeded turf when compared with areas of both old sward and reseeded turf that were not fertilized and mole drained.

2720. Loddesol, A. SETTLING PROBLEMS ON MARSHES. (No) Nord. Jordbrforsk. 39(1/2): 136-139. 1957. 11 N752
Discussion, pp. 141-145.

2721. Loughry, F. G. NATURAL SOIL DRAINAGE AND ROOT DEVELOPMENT IN SOME PENNSYLVANIA SOILS. Pa. Acad. Sci. Proc. 35: 82-89. 1961.

A report was given on the root development on different soil types in Pennsylvania due to natural soil drainage.

2722. Luken, H. SALINE SOILS UNDER DRYLAND AGRICULTURE IN SOUTHEASTERN SASKATCHEWAN (CANADA) AND POSSIBILITIES FOR THEIR IMPROVEMENT. II. EVALUATION OF EFFECTS OF VARIOUS TREATMENTS ON SOIL SALINITY AND CROP YIELDS. Plant and Soil. 17(1): 26-48. Ref. Aug. 1962. 450 P696

An evaluation was given of the effect of mulch, manure, high rates of fertilizers, and Krilium on soil salinity and crop yields in Saskatchewan, Canada.

2723. Luken, H. SALINE SOILS UNDER DRYLAND AGRICULTURE IN SOUTHEASTERN SASKATCHEWAN (CANADA) AND POSSIBILITIES FOR THEIR IMPROVEMENT. III. INFLUENCE OF ORGANIC MATTER APPLICATION ON SOIL SALINITY AND CROP YIELDS. Plant and Soil. 17(1): 49-67. Ref. Aug. 1962. 450 P696

A report was given on a growth room experiment where peat was added to saline soils and a field experiment where manure was added to saline soils in Saskatchewan, Canada. Both treatments increased the yield of crops and reduced the salinity of the soil.

2724. Lull, H. W. FOREST SOIL-MOISTURE RELATIONS IN THE COASTAL PLAIN SANDS OF SOUTHERN NEW JERSEY. Diss. Abs. 16(12): 2268-2269. Dec. 1956. 241.8 M58

A report was given on forest-soil moisture relations on coastal plain sand of New Jersey.

2725. Lunin, J., and Gallatin, M. H. BRACKISH WATER FOR SUPPLEMENTAL IRRIGATION. Soil Conserv. 23(6): 117-119. 1958. 1.6 So3S

A report was given on the use of brackish water for supplemental irrigation in the eastern area of the United States.

2726. Lunin, J., and Gallatin, M. H. EFFECT OF SALINE WATER ON THE GROWTH AND CHEMICAL COMPOSITION OF BEANS. I. INFLUENCE OF SOIL DILUTION. Soil Sci. Soc. Amer. Proc. 24(3): 231-234. 1960. 56.9 So3

A Bladen clay soil was divided into two parts and one part diluted with an equal part of sand. Both the whole and diluted soil were potted and planted to beans. Between the seedling stage and the initiation of flowering, four 1-inch applications of dilute synthetic sea water having EC values of 1, 2, 4, 6, and 8 mmho. per cm. were applied. After harvesting both pods and tops, beans were again planted and the saline irrigation treatments repeated.

Saline irrigations produced greater reductions in yield of both pods and tops on the diluted soil than on the whole soil. Little or no differences in composition were obtained between plants grown on the whole and the diluted soil. The Ca, Mg, and Na content of the plant increased with increasing salinity, but no change in K content was observed. The cation composition of the saturation extract, expressed as me. per 100 g., was the same for both soils, but the exchangeable cation composition of the whole soil was double that of the diluted soil.

2727. Lunin, J., Gallatin, M. H., and Batchelder, A. R. THE EFFECT OF SALINE WATER ON THE GROWTH AND CHEMICAL COMPOSITION OF BEANS. II. INFLUENCE OF SOIL ACIDITY. Soil Sci. Soc. Amer. Proc. 25(5): 372-376. 1961. 56.9 So3

Two greenhouse experiments were conducted to determine the relationship between soil acidity and salinity on the growth and chemical composition of snap beans.

One experiment was carried out on a Sassafras soil limed to give three pH levels. During the growth of the crop, four 1-inch irrigations of dilute synthetic sea water having EC values of 2, 4, and 8 mmhos./cm. were applied as well as demineralized water. Growth depression with increasing salinity was greatest on the most acid soil. Increasing salinity depressed pH values and increased the availability of manganese in the soil and its uptake by the plant. Liming had the reverse effect.

The second experiment was conducted on the Portsmouth soil limed to give four levels of base saturation. Increasing salinity decreased soil pH but did not increase the availability of Fe, Al, or Mn to a level which might depress plant growth. Liming increased the yield of beans but no significant interaction between base saturation and salinity on yields was obtained.

2728. Lunin, J., Gallatin, M. H., and Batchelder, A. R. THE EFFECT OF STAGE OF GROWTH AT TIME OF SALINIZATION ON THE GROWTH AND CHEMICAL COMPOSITION OF BEANS. II. SALINIZATION IN ONE IRRIGATION COMPARED WITH GRADUAL SALINIZATION. Soil Sci. 92(3): 194-204. 1961. 56.8 So3

Gradual salinization initiated at pre-planting, was more inhibitory than like salinity levels introduced abruptly at later stages of development. Attempts to precondition the plant by gradual salinization were unsuccessful when yield was used as a criterion.

Transpiration was affected primarily by the soil solute suction at the time of measurement, whereas yields, moisture content, and cation accumulation were also significantly influenced by the stage of growth at which salinization occurred. Preconditioning affected these variables only insofar as the plant was exposed to a certain degree of salinity for a longer time.

2729. Lunin, J., Gallatin, M. H., and Batchelder, A. R. SALINE IRRIGATION OF VEGETABLE CROPS AT VARIOUS GROWTH STAGES. I. EFFECT ON YIELDS. Agron. J. 55(2): 107-110. 1963. 4 Am34P

There were significant reductions in yield for all crops with increasing salinity. With the exception of beet tops and broccoli tops, reductions in yields were significantly less when salinized at more mature growth stages. Tomato tops and pepper tops were the only crops tested which showed a significant interaction between growth stage and salinity.

2730. Lunin, J., Gallatin, M. H., and Batchelder, A. R. EFFECTS OF SUPPLEMENTAL IRRIGATION WITH SALINE WATER ON SOIL COMPOSITION AND ON YIELDS AND CATION CONTENT OF FORAGE CROPS. Soil Sci. Soc. Amer. Proc. 28(4): 551-554. July-Aug. 1964. 56.9 So3

Dilutions of synthetic sea water were used for supplemental irrigation on small plots containing alfalfa, Kentucky 31 Fescue, orchardgrass, and ladino clover. One treatment irrigated with nonsaline water and a nonirrigated control were also included. Significant increases in yield due to irrigation were obtained in only a few instances during the second through fourth year of study, but during the first year two of the four cuttings of all four crops responded to supplemental irrigation. Where several irrigations were applied, yields tended to decrease with increasing salinity, with ladino clover being the most sensitive of the four crops tested.

2731. Lunin, J., Gallatin, M. H., and Batchelder, A. R. INTERACTIVE EFFECTS OF SOIL FERTILITY AND SALINITY ON THE GROWTH AND COMPOSITION OF BEANS. Amer. Soc. Hort. Sci. Proc. 85: 350-360. 1964.

Beans were grown in the greenhouse at 6 fertility levels and 5 levels of salinization. Yields of both vines and pods increased with increasing levels of NPK at almost all saline levels. Lime had little effect on yields on nonsaline soil, but greatly increased yields of pods at high salinity levels where not fertilized. Yields of both vines and pods decreased with increasing salinity, but within a given salinity level yields increased with increasing fertility. The mitigating effects of high fertility on yield reductions due to salinity were more pronounced for pods than vines. The cation contents of the leaves and stems were more directly related to the cation content of the soil saturation extract than to the exchangeable cation content of the soil.

2732. Lunin, J., Gallatin, M. H., and Batchelder, A. R. INTERACTIVE EFFECTS OF BASE SATURATION AND EXCHANGEABLE SODIUM ON THE GROWTH AND CATION COMPOSITION OF BEANS. Soil Sci. 97(1): 25-33. 1964. 56.8 So3

Green beans were grown on a Bladen silt loam treated with $CaCO_3$, $MgCO_3$, and $NaHCO_3$ to give three levels or classes of base saturation and four levels of exchangeable Na. Two groups of these treatments were prepared: one in which the exchangeable Ca + Mg varied within a base-saturation level and one in which the exchangeable Ca + Mg was constant.

Yields decreased with increasing exchangeable Na, with the greatest decreases occurring in the group in which Ca + Mg was constant. Yields of both pods and tops were higher for the medium level of base saturation than for the high level. Highly significant yield interactions were obtained between base saturation and exchangeable Na effects for both groups.

2733. Lunin, J., and Stewart, F. B. THE EFFECT OF SOIL SALINITY ON AZALEAS AND CAMELIAS. Amer. Camelia Ybk. 1961: 136-141. 1961. 97.31 Am32

A report was given on the effect of soil salinity on azaleas and camelias.

2734. Lunin, J., and Stewart, F. B. THE EFFECT OF SOIL SALINITY ON AZALEAS AND CAMELLIAS. Hort. Sci. Soc. Proc. 77: 528-532. 1961. 81 So12

It was concluded that an EC_e value of 3 mmhos./cm. should be the permissible limit for soil salinity for azaleas or camellias. This would be equivalent to a salt concentration of 2500 p.p.m. of salt in the soil saturation extract. Salinity measurements made on 1:1 soil water ratios would have a much lower limit and would vary with different soil textures.

Soil salinity arises from both fertilizer added and from the irrigation water used. It is the salt content of the soil solution that determines salt injury. Suitability of a given water for irrigation must be judged not only by its salt content, but also the manner in which it is to be used and the soil type it is used on.

2735. Lupinovich, I. S. CHANGES IN PHYSICAL AND BIOCHEMICAL PROPERTIES OF PEAT-BOGGY SOILS UNDER AMELIORATION AND AGRICULTURAL USE. (Rus) Internatl. Cong. Soil Sci. Rpt. Soviet Soil Sci. 7: 427-434. Ref. 1960. 56.09 In847D
English summary.

A report was given on the physical and chemical changes of peat-bog soils in the USSR after they are drained and cultivated.

2736. Lutz, J. F. THE INTERRELATIONSHIPS OF SOIL PHYSICAL CONDITIONS AND DRAINAGE. N.C. Agr. Expt. Sta. Tech. B. 139, 27 pp. Apr. 1960. 100 N81

A discussion was given on the interrelationship of soil physical conditions and drainage in North Carolina.

2737. Lyerly, P. J. SALINITY CONTROL IN IRRIGATION AGRICULTURE. II. SOIL MANAGEMENT. World Farming. 6(10): 4-7, 34. Oct. 1964. 30.08 W89

A report was given on the specific salt tolerance of crops to be grown to determine what steps to take to reduce soil and water "toxic limits" in California.

2738. Lyles, L., and Fanning, C. D. EFFECTS OF PRESOAKING, MOISTURE TENSION, AND SOIL SALINITY ON THE EMERGENCE OF GRAIN SORGHUM. Agron. J. 56(5): 518-520. 1964. 4 Am34P

The effects of presoaking, moisture tension, and soil salinity on emergence of RS610 grain sorghum were determined. Major interest was in obtaining seedling emergence in saline soil. Soaking increased emergence slightly (maximum 26 percent) where the moisture tension exceeded 0.33 atm. and salt concentration of the saturated soil extract did not extract did not exceed 10 mmhos./cm. Soaked seed emerged about one day before unsoaked seed at each salinity level.

2739. McAlpine, R. G. FLOODING KILLS YELLOW POPLAR. Forest Farmer. 19(3): 9, 13-14. 1959. 99.8 F7692

For best growth, yellow-poplar needs abundant moisture and good drainage during the entire growing season.

Trees grow well on the edge of smaller creeks where summer flooding is frequent but of short duration.

A controlled study of season and duration of flooding of transplanted seedlings in small tanks has shown that the length of the flood period was important. Seedlings were able to withstand flooding during the growing season for 3 days with little mortality or loss of growth, but extending the period increased mortality until all were dead after 14 days.

Flooding injury to young yellow-poplar trees may give a clue to the conspicuous absence of this species in the lower areas of the bottom lands.

2740. McGaughey, P. H., and Orlob, G. T. SURFACE AND GROUND-WATER CHANGES RESULTING FROM WASTE-DISPOSAL PRACTICES. Conf. On Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 119-124. Jan. 1958. 55.9 C7693

A consideration of the nature of sewage and industrial wastes, and of the treatment required prior to their discharge in the interests of public health and other beneficial uses such as recreation and aquatic wildlife culture, leads to the general conclusion that domestic and waste disposal practices that conform to the requirements of other beneficial uses do not lead to serious water-quality problems for the user of irrigation water. This assumes, of course, that dilution with other surface for ground water occurs prior to irrigation use of water. The principal exceptions to this conclusion occur when sewage or industrial waste waters, either singly or in combination, are applied directly to agricultural land. In this case, clogging of the soil, bacterial pollution of edible plants, excess sodium, toxic cations, or anaerobic soil conditions might result.

2741. Magi, K. EXPERIMENTAL STUDY OF THE PERFORMANCE OF SUB-DRAINAGE ON SOILS CHARACTERIZED BY SLIGHT WATER PERMEABILITY. (Rus) Estonskaya Sel'Skokhoz. Akad. Sborn. Nauch. Trudov. 31: 36-49. 1963. 106 Es83
German summary.

2742. Mahood, H. E. THE EFFECTIVENESS OF THE HOOPER PILOT DRAIN IN DRAINAGE OF ADJACENT LANDS OVERLYING AN ARTESIAN AQUIFER. (Abs.) Utah Agr. Col. Monog. Ser. 4(4): 60-61. June 1956. 276 Ut15M

An abstract was given of a thesis on the effectiveness of the Hooper Pilot Drain in drainage of adjacent land overlying an artesian aquifer.

The drain was effective to a distance of about 500 feet for draining off surface water and water coming up from the aquifer.

2743. Makarov, V. T., Lebedeva, G. F., and Spiridonov, Y. Y. KALE CULTURE ON DRAINED BOGS AND BOTTOMLANDS IN THE RYAZAN SECTION OF THE MESHCHERA VALLEY. (Rus) In Vilenskii, D. G., ed. ISSLEDOVANIE PRIRODNYKH USLOVII SEL'SKOGO KHOZYAISTVA MESHCHERSKOI NIZMENNOSTI. 1: 209-231. 1961. 56.26 V71Is

2744. Makarova, G. F. SALT REGIME OF CHESTNUT SOIL COMPLEX IN THE LAKE SIVAH AREA (IRRIGATED VINEYARDS). Pochvovedenie. 10: 103-116. Ref. Oct. 1964. 57.8 P34
English translation—Soviet Soil Sci. 10: 1097-1108. Ref. Oct. 1964. 57.8 P34Ae

A discussion was given on the effects of drainage on the salt regime of some irrigated vineyards in the USSR.

2745. Maki, T. E. HOW TO IMPROVE FOREST SITES. Pulp and Paper. 31(7): 113-114, 116, 118. July 1957. 302.8 P11

A report was given on the use of drainage and fertilizers to improve forest soils. In North Carolina, in areas where adequate drainage has been obtained, the site index has been raised as much as 25 feet over that which the land represented before drainage.

2746. Maslov, B. S. WATER REGIME OF A PEAT SOIL IN SUMMER; UNDER THE CONDITIONS OF THE MESCHERSK LOWLANDS. (Rus) Pochvovedenie. 1961(3): 48-59. Ref. March 1961. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 3: 273-282. Ref. March 1961. 57.8 P34Ae

A report was given on the water regime of drained peat bogs in the summer in the Meschersk lowland in the U.S.S.R. Excessive drainage of the peat bogs in this area was very harmful.

2747. Maslov, B. S. WATER REGIME OF PEAT SOILS IN THE SPRING. (Rus) Pochvovedenie. 10: 73-82. Ref. Oct. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 10: 971-977. Oct. 1963. 57.8 P34Ae

Three year investigations (1958-60) were made on the formation of the water regime in drained low moors in the U.S.S.R. The water regime largely depends upon the depth of the ground water level and the conditions of water accumulation in winter in the zone of peat soil freezing. Recommendations were given on the application of the water balance method during this period of time.

2748. Maslova, A. A. WATER REGIME OF YAKHROMA RIVER VALLEY SOD-GLEY AND GLEYEY SOILS DRAINED BY CLOSED DRUMS. (Rus) Pochvovedenie. 9: 25-32. Ref. Sept. 1964. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 9: 910-916. Ref. Sept. 1964. 57.8 P34Ae

A report was given on moisture regime of some subsurface drained soils in the U.S.S.R.

2749. Matsumi, S. STUDIES ON THE MATURING PROCESS OF PEAT SOILS. III. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 1957(72): 103-112. Feb. 1957. 107.6 H68

2750. Matsumi, S., Shoji, S., Sawada, Y., Fujimori, N., and Miyazaki, N. INFLUENCE OF THE CUTTING OF THE PEAT STRATA ON THE GROUND WATER LEVEL. II. CONTINUANCE OF THE LOWERING EFFECT OF THE GROUND WATER LEVEL AND PHYSICAL AND CHEMICAL PROPERTIES OF PEAT SOILS. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 1957(73): 79-87. Ref. Mar. 1957. 107.6 H68
English summary.

Drainage experiments on cutting the peat strata have been made on an unreclaimed high moor field at Babia, Japan, since 1953 to study the effects of lowering the ground water level. It was concluded that the drainage accelerated the decomposition of the peat soil in both physical and chemical properties.

2751. Mazing, V. V. EXPERIMENT IN DETERMINING THE DEGREE OF DRAINAGE OF FOREST SWAMPS BY THE NATURE OF ITS VEGETATION. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 31: 142-148. 1955. 99.9 Ak1

2752. Medvedeva, V. M. ON THE PROBLEM OF THE EFFECTIVENESS OF DRAINING PINE STANDS IN KARELIA. (Rus) Leningrad. Nauch.-Issled. Inst. Lesn. Khoz. Sborn. Rabot po Lesn. Khoz. 5: 116-126. 1962. 99.9 L545

2753. Mello, A. T. De. DRAINAGE OF COFFEE PLANTATIONS. (Por) Sao Paulo Supt. dos Serv. do Cafe. B. 23, i.e. 33(371): 15-18. Jan. 1958. 68.29 Sa63

2754. Meron, A., and Ludwig, H. F. SALT BALANCES IN GROUND WATER. Amer. Soc. Civil Engin. Trans. 129: 667. 290.9 Am3

A digest was given of a study of salt balance in ground water. The original study was published in J. Sanitary Div., ASCE 89(SA 3): 41-61. June 1963.

2755. Meshcheriakov, D. P., and Markov, E. S. THE IMPORTANCE OF SOIL AND BOTANIC INVESTIGATIONS IN DRAINAGE PROJECTS. (Rus) Pochvovedenie. 1957(2): 131-133. Feb. 1957. 57.8 P34

2756. Meshechok, B. ON DEPTH AND DISTANCE OF DRAINAGE DITCHES. (No) Norsk Skogbruk. 6(10): 373-378, 381. Ref. May 1960. 99.8 N815
English summary.

Six experiments were reported on the effect of drainage depth and spacing on forest drainage in Norway.

2757. Metsanheimo, U. THE PROBLEMS ASSOCIATED WITH FOREST DRAINAGE IN NORTH-FINLAND; FROM THE VIEWPOINT OF TREE SPECIES PROPORTIONS. (Fi) Suo. 11(2): 22-25. June 20, 1960. 54.8 Su7
English summary.

The problems associated with forest drainage in North Finland were discussed from the viewpoint of tree species proportions. The drawbacks to bog drainage are: The tendency of the lands to become heathy; frost action; damage caused by crusted snow; inundations; peat fires; damage caused by animals; and damage caused by brush clearing.

2758. Milyauskas, V. EFFECT OF DRAINAGE ON PHYSICAL AND CHEMICAL PROPERTIES OF THE EXCESSIVELY WET SOILS OF THE LITHUANIAN SSR. (Rus) Pochvovedenie. 1: 61-74. Jan. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 1: 43-53. Jan. 1963. 57.8 P34Ae

A report was given on the effect of drainage on the physical and chemical properties of water-logged soils of Lithuania.

2759. Mirchandani, P. M., and Manrai, G. K. EFFECT OF TERRACING ON UPLAND CROPS. J. Soil and Water Conserv. India. 7(2/3): 73-77. Jan./Apr. 1959. 56.8 J824

A report was given on the effect of five kinds of terraces on three upland crops in India. Graded channel terraces and bench terraces graded with open ends gave the best results.

2760. Mitra, S. P., and Singh, R. LOSS OF NITROGEN FROM ALKALI SOILS. Soil and Plant Food. 4: 75-80. 1958. 56.8 So38

A major portion of the nitrogen added as artificial fertilizers like urea, ammonium sulphate and sodium nitrate to the alkali soil was lost without any benefit to it. The loss was maximum in case of urea and minimum in case of sodium nitrate.

Apart from leaching, denitrification and other sources of nitrogen loss which usually occur in soil formation of ammonium carbonate were additional sources of nitrogen loss in alkali soils. The rate of nitrogen loss was fast in the beginning, and decreased with time. The percentage of loss is greater at a lower concentration of fertilizer than at a higher concentration. Organic matter and phosphate rocks retard nitrogen loss.

2761. Mitra, S. P., and Skanker, H. FORMATION OF ALKALI SOILS BY NEUTRAL SALT SOLUTIONS. Soil and Plant Food. 3: 145-147. 1958. 56.8 So3

As salt accumulation is the prerequisite of the formation of alkali soils, saline soils were produced in the laboratory by adding different amounts of KCl, NaCl, K_2SO_4, and Na_2SO_4 to the normal soil, having a pH 7.6. It was found that the pH of the soil extract was less where KCl or NaCl were added. Like Na-soils, K-soils are always alkaline and sometimes have higher pH values. Higher pH values can be obtained by treating the normal soil with more concentrated solution of KCl. The presence of Ca-ions was found to suppress the hydrolysis of K soils and hence lower pH values were obtained.

2762. Montanari, V., Baldini, G. F., and Felicori, F. THE DANGEROUS EFFECTS OF THE EXCESSIVE DRYING ESPECIALLY IN THE TURFY LANDS AND METHODS FOR PREVENTION THEREOF. (Fr) Cong. Irrig. and Drain. Trans. 5(5): R.17.293-R.17.303. map. 1963. 55.9 C7652 English summary.

A report was given of the dangerous effect of excessive drainage on marsh lands in Italy. Methods to prevent excessive drainage were discussed.

2763. Muckel, D. C. WATER QUALITY RELATED RESPONSIBILITIES OF THE DEPARTMENT OF AGRICULTURE. Pacific Southwest Inter-agency Committee, Water Quality Tech. Subcommittee Proc. 17-19. Apr. 1964.

A report was given on research and related responsibilities on water quality by the U. S. Department of Agriculture.

2764. Mulkey, J. R., Jr., and Bloodworth, M. E. SALT DISTRIBUTION IN A REAGAN SILT LOAM AFTER FIVE YEARS OF CONTINUOUS IRRIGATION. Tex. Agr. Expt. Sta. Misc. P. 749, 7 pp. 1964. 100 T31M

The results of a laboratory experiment to investigate the extent of salt accumulation in a Reagan sandy loam soil after 5 years of irrigation with saline water were given.

The data showed a continuous buildup of soluble salts in the Reagan soil with prolonged application of saline water. The osmotic pressure in the 0-18 inch zone increased 6.35 atmospheres after 5 years of irrigation, or an average of 1.27 atmospheres per year.

A 6-inch border application of irrigation water caused a 4.28 atmosphere increase in the osmotic pressure of the 0-24-inch zone, while a 12-inch application of water by the border method caused a 3.96 atmosphere decrease at comparable depths.

2765. Myers, J. M., and Harrison, D. S. WATER CONTROL AS A LIMITING FACTOR IN FIELD CROP PRODUCTION IN FLORIDA. Soil and Crop Sci. Soc. Fla. Proc. 20: 329-331. Ref. 1960. 56.9 So32

A report was given on the effect of water control measures on filed crop production in Florida. The use of surface drainage, subsurface drainage, surface irrigation, subsurface irrigation, and terracing were some of the items discussed.

2766. Myers, V. I. DRAINAGE PROBLEMS. In GUIDE FOR CITRUS PRODUCTION IN THE LOWER RIO GRANDE VALLEY. Tex. Agr. Expt. Sta. B., 1002: 10-11. Dec. 1963. 100 T31S

A discussion was given on the drainage problems for citrus production in Texas.

2767. Ogawa, K. THE DEVELOPMENT OF FARM MANAGEMENT BY THE EXECUTION OF UNDERDRAINAGE. (Ja) Yamagata U. B. 3(1): 175-190. Feb. 1959. 22.5 Y1 English summary.

A report was given on the use of secondary-cropping in the paddy fields after the development of a good drainage system in Japan rice fields.

2768. O'Grady, L. J. INFLUENCE OF THE SOIL ON NUTRITIVE QUALITY OF THE PLANT. (Fr) Agr. [Montreal] 20(1): 1-2, 4-5. (Cont.) Jan./Feb. 1963. 7 Ag82

2769. Okajima, H. ON THE ABSORPTION OF WATER AND SALT BY THE RICE PLANT ROOT SYSTEM, ESPECIALLY MUTUAL RELATIONSHIP BETWEEN YOUNG AND OLD ROOTS. Soil Sci. and Plant Nutr. 7: 104-114. 1961. 56.8 So38

In order to investigate the mechanism of absorption of water and salt by the plant root system, rice plants with the young and the old root groups separated were cultured. The results obtained showed that a plant as a whole has a mutual complementary relationship between its old and young roots, concerning water and salt absorption.

2770. Okruszko, H., and Szuniewicz, J. SOME ASPECTS OF PEAT SOIL OVERDRAINAGE IN POLAND. Cong. Irrig. and Drain. Trans. 5(5): R.17.229-R.17.238. 1963. 55.9 C7652

A report was given of peat soil overdrainage in Poland.

2771. Okuda, A., and Yamaguchi, M. DISTRIBUTION OF NITROGEN-FIXING MICROORGANISMS IN PADDY SOILS IN JAPAN. Cong. Internatl. de la Sci. du Sol. Rap. 6(C, colloque du Riz.): 521-526. 1956. 56.09 In8452

A report was given on the distribution of algae in paddy soils in Japan to evaluate the practical significance of the nitrogen fixation by blue-green algae.

2772. Ongaro, G. WHY THE LAND OF THE PO DELTA IS SINKING. (It) Gior. di Agr. 68(25): 234. June 22, 1958. 16 It1G

2773. Ordoveza, J. L., Aglibut, A. P., and Dano, P. L. UNDERDRAINAGE INCREASES CROP YIELD. Manila U. Philippines Col. Agr. Mon. B. 21(12): 7-8. June 1957. 109.5 M312

A report was given on an experiment using clay tile, concrete tile, and bamboo tile in the Philippines. They were all used successfully, but the corn ground in the area where the tile rows were placed 25 meters apart gave better yields than those placed 50 meters apart. The advantages of surface drainage and closed drainage were given.

2774. Orlov, A. I., and Izvekov, A. A. THE EFFECT OF DRAINAGE ON FOREST-GROWING PROPERTIES OF PEAT-HUMUS SOILS. (Rus) Pochvovedenie. 2: 40-49. Ref. Feb. 1960. 57.8 P34
English translation—Soviet Soil Sci. 2: 141-148. Feb. 1960. 57.8 P34Ae

A report was given on the effects of drainage of forested peat-humus soils in the U.S.S.R.

2775. Ostrowski, J. SOME OBSERVATIONS ON THE EFFECT OF DRAINAGE IN CONDITIONS OF PRECIPITATION WATER SUPPLY WITHOUT THE INFLUENCE OF PROPER GROUND WATER LEVEL. (Pol) Warsaw Szkola Glowna Gosp. Wiejsk. Melioracje Rolne. 3: 17-33. map. 1961. 54.9 W26
English summary.

Some observations were given on the effect of drainage on the effects of rainfall on heavy clay soils in Poland.

2776. Nakamura, T. PEAT BOG OF HOKKAIDO AND OVERDRAINAGE. Cong. Irrig. and Drain. Trans. 5(5): R.17.91-R.17.108. 1963. 55.9 C7652

A report was given on the effects of overdrainage of the Hokkaido peat bog in Japan.

2777. Nakashima, S., Tsukamoto, Y., and Fujita, H. STUDIES ON THE EFFECT OF HILLSIDE REPAIRING WORKS. (Ja) Tokyo U. Forests Misc. Inform. 14: 37-51. Mar. 1962. 99.9 T572
English summary.

A report was given on the effect of terraces and brush covering for erosion control and the growth of trees on hilly areas in Japan.

2778. Nelson, J. L., and Crawford, C. L. FERTILIZER NEEDS OF LEVELED LAND IN THE COLUMBIA BASIN. Wash. Agr. Expt. Sta., Sta. C. 368, 4 pp. 1960. 100 W22E

Development of a typical Columbia Basin Project farm unit includes extensive land leveling in preparation for irrigation. Approximately 90 percent of the irrigable land in the Basin is surface irrigated. Most of this land must be leveled to some degree. "Cuts" and "fills" of 3 to 4 feet are not uncommon. After leveling, the land usually irrigates well, but often little or nothing will grow on the severely cut areas for several years.

From 5 to 50 percent of a farm unit may be affected by poor crop growth because of leveling. Most serious effects are usually found where more than a foot of soil has been removed or where a fill of more than a foot has been made with subsoil from the second foot or deeper.

2779. Nesterova, G. S. INFLUENCE OF DRAINAGE OF WATER-AIR REGIME IN THE MEADOW SOD SURFACE-GLEYED SOILS OF THE SOUTHERN PART OF KHABAROVSK KRAY. (Rus) Pochvovedenie. 7: 84-93. July 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 7: 684-691. July 1963. 57.8 P34Ae

A report was given on the effect of drainage on the water-air regime in the meadow-soddy surfaced-gleyed soils of Khabarovsk, territory of the U.S.S.R.

2780. New Mexico State University, Agricultural Extension Service. KNOW THE SALT CONTENT BEFORE YOU APPLY WATER TO YOUR SOIL. N. Mex. State U. Agr. Ext. C. 330, 6 pp. folder. Mar. 1963. 275.29 N463E

An illustrated report was given on the effect of saline irrigation water on crops and soils in New Mexico. The growing of crops with good and moderate salt tolerances were discussed.

2781. Neznaev, M. F. TECHNOLOGY OF THE INITIAL TREATMENT OF DRAINED SWAMPS. (Rus) Gidrotekh. i Melior. 1962(2): 32-41. Feb. 1962. 290.8 G362

2782. Nieman, R. H. SOME EFFECTS OF SODIUM CHLORIDE ON GROWTH, PHOTOSYNTHESIS, AND RESPIRATION OF TWELVE CROP PLANTS. Bot. Gazette. 123: 279-285. 1962. 410 Ec7

The effect of NaCl on some aspects of growth and on rates of photosynthesis and respiration was examined with twelve crop species covering a wide range of salt tolerance. Plants were grown in the greenhouse on gravel cultures irrigated with either a base nutrient solution (control) or base nutrient plus 1, 2, 3, or 4 atm. OP of NaCl. Photosynthesis and respiration were measured with tissue samples in the Warburg apparatus.

2783. Nikonov, M. N., and Minkina, T. I. NATURE OF THE CHANGE IN PEAT UNDER THE INFLUENCE OF AERATION. (Rus) Pochvovedenie. 1: 76-79. Jan. 1961. 57.8 P34
English translation—Soviet Soil Sci. 1: 63-67. Jan. 1961. 57.8 P34Ae

Rapid changes occur in peat layers under the influence of aeration, which are reflected both in the morphology and composition of the peat.

The plant fiber becomes decomposed and the peat becomes enriched in biochemically stable elements.

Parallel with the increase in the degree of decomposition of peat, its ash content increases because of the mineralization of its organic substances. These processes are more intense in peats, which initially have a low degree of decomposition, and are slower in well-decomposed peats.

2784. Norden, A. J. RESPONSE OF CORN (ZEA MAYS L.) TO POPULATION, BED HEIGHT, AND GENOTYPE ON POORLY DRAINED SANDY SOIL. I. ROOT DEVELOPMENT.. Agron. J. 56(3): 269-273. 1964. 4 Am34P

The root response of two hybrid corn varieties to plant populations and bed heights on a poorly drained sandy soil (Leon fine sand) was studied at Gainesville, Fla., in 1960-61. Plant population had the greatest effect on corn root development.

2785. Numminen, E. FERTILIZATION INCREASES DRAINAGE TASKS. (Fi) Metsataloudellinen Aikakauslehti. 12: 458-461. map. Dec. 1964. 99.9 F49
English summary.

A report was given on past and future drainage activities in Finland. The area to be drained has increased with the advance of ditch-digging methods and the adoption of fertilization to speed up growth. An account was given of the areas in Finland which can be economically drained when various types of fertilizers are used to speed up growth.

2786. Paarlahti, K. THE EFFECT OF FOREST DRAINAGE ON THE MICRO-ORGANISMS IN SOME SWAMP TYPES. (Fi) Metsataloudellinen Aikakauslehti. 12: 427-429. 1958. 99.9 F49
English summary.

The effects of drainage on microorganisms were shown only in the thin surface layer; changes resulting from drainage could not be seen deeper than 35 cm.

2787. Paarlahti, K. CHANGES CAUSED BY DRAINING IN THE EDALPHIC FACTORS ON SOME BOG TYPES. (Fi) Suo. 10(1): 13-18. Apr. 15, 1959. 54.8 Su7
English summary.

The degree of effectiveness of some edalphic factors was studied on three virgin bog types on the 25-year results of drainage of these bogs in Finland.

2788. Pearson, G. A. FACTORS INFLUENCING SALINITY OF SUBMERGED SOILS AND GROWTH OF CALORO RICE. Soil Sci. 87: 198-206. April 1959. 56.8 So3

A greenhouse experiment designed to study the effect of initial soil salinity, salt content of the irrigation water and rate of drainage on the salinity of two submerged soils (Chino clay and Diablo clayey loam) and the growth of Caloro rice was reported.

2789. Pearson, G. A. TOLERANCE OF CROPS TO EXCHANGEABLE SODIUM. U.S. Dept. Agr., Agr. Inform. B. 216, 4 pp. 1960. 1 Ag84Ab

A report was given on the tolerance of crops' to exchangeable sodium. Exchangeable sodium was defined and the effects of exchangeable sodium on crops and soils were described. The relative tolerance of some crops to exchangeable sodium were given along with methods to improve sodic soils.

2790. Pearson, G. A. A TECHNIQUE FOR DETERMINING THE SALT TOLERANCE OF RICE. "Newsletter" Internatl. Rice Comn. 10(1): 5-7. 1961. 59.9 In83N

The salt tolerance of a crop is based on the relationship between the salt concentration in the soil solution and the yield of the crop. Difficulties may be encountered, however, in regulating the salinity status of a submerged soil used for rice. A technique, which has been used at the U.S. Salinity Laboratory and found satisfactory in such cases, was discussed.

2791. Pearson, G. A., and Ayers, A. D. RICE AS A CROP FOR SALT-AFFECTED SOIL IN PROCESS OF RECLAMATION. U.S. Dept. Agr., Agr. Res. Serv. Prod. Res. Rpt. 43, 13 pp. 1960. Ag 281.9 Ag8

Reclamation of salt-affected (saline, sodic, or saline-sodic) soils involves leaching excess salt out of the root zone, (washing it out with water). This usually necessitates ponding water on the surface.

A discussion was given on how rice can sometimes be grown during leaching, since it can tolerate prolonged submergence.

2792. Pearson, G. A., and Bernstein, L. SALINITY EFFECTS AT SEVERAL GROWTH STAGES OF RICE. Agron. J. 51: 654-657. 1959. 4 Am34P

The effect of soil salinity at three stages of development on the growth of Caloro rice was investigated in the greenhouse by maintaining careful control of the rate of percolation and the conductivity of the irrigation water. The results indicated that salinity inhibited growth more severely at earlier stages of growth than at later stages. Even when based on equal weighted-mean conductivities, salinity during the tillering stage inhibited growth twice as much as during heading. The relationship between growth and salinity can be closely expressed by a multiple regression equation relating growth to salinity during tillering, heading, and maturation stages.

2793. Pearson, G. A., Goss, J. A., and Hayward, H. E. THE INFLUENCE OF SALINITY AND WATER TABLE ON THE GROWTH AND MINERAL COMPOSITION OF YOUNG GRAPEFRUIT TREES. Amer. Soc. Hort. Sci. 69: 197-203. Ref. 1957. 81 So12

A report was given on the influences of salinity and water table on the growth and mineral composition of young grapefruit trees in California.

2794. Pearson, H. E. IRRIGATION AND SOIL SALINITY. In Tourje, E. C., ed. CAMELLIA CULTURE. pp. 360-366. Macmillan, New York. 1958. 97.31 T64

To obtain maximum growth of camellias, salinity levels should be kept as low as possible. The recomended cure for soil salinity is adequate leaching followed by proper fertilization and irrigation methods.

2795. Pearson, P. W. USE THE SOIL TO IMPROVE THE SOIL. Plant Food Review. 4(1): 14-16, 31. 1958. 57.8 P694

A report was given on the use of fertilizer and lime to improve soil after land levelling, digging ditches, terracing, et cetra, where subsoil material is exposed or where the topsoil is thin.

2796. Pereverzev, V. N. INFLUENCE OF CULTIVATION ON THE VARIATION OF SOME HYDROPHYSICAL PROPERTIES OF SWAMPY SOILS IN MURMANSK REGION. (Rus) In Kirovsk Polyarno-Al'piiskii Botanicheskii Sad. VOPROSY BOTANIKI I POCHVOVEDENIYA V MURMANSKOI OBLASTI. pp. 166-172. 1962. 459.2 K63

2797. Pessi, Y. ON THE INFLUENCE OF BOG DRAINING UP ON THERMAL CONDITIONS IN THE SOIL AND IN THE AIR NEAR THE GROUND. Acta Agr. Scand. 8(4): 359-374. 1958. 11 Ac82

The effects of bog drainage on the thermal conditions in the soil and in the air near the ground were given for Finland.

Drainage lowered the daily minimum temperature of the air adjacent to the soil surface in the early part of the summer and midseason. In the autumn, the difference had leveled out, and by September, the opposite relation was true.

2798. Petrunya, N. I. EFFECT OF MINOR ELEMENTS ON YIELD OF CARROTS GROWN ON A DRAINED PEAT BOG. (Rus) Leningrad Sel'skokhoz. Inst. Zap. 81: 18-26. 1961. 106 L543

2799. Pisar'kov, K. A., and Timofeev, A. F. EFFECTIVENESS OF DRAINAGE OF PINE AND SPRUCE-WHORTLEBERRY GROVES. (Rus) Lesn. Khoz. 8(12): 19-23. Dec. 1955. 99.8 L5622

2800. Pizer, N. H. THE COASTAL FLOODS OF JANUARY-FEBRUARY, 1953; AN ACCOUNT OF SOIL AND CROP PROBLEMS WHICH FOLLOWED IN THE EASTERN PROVINCE. Agr. Prog. 29: 34-53. 1954. 10 Ag86

A discussion was given of the effects of sea water flooding on soil and crop problems in England. The treatments used after the coastal floods in January and February in 1953 were given.

2801. Plyusnin, I. I. CHANGES IN SOIL PROPERTIES AS CAUSED BY RECLAMATION. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 56: 101-106. 1960. 20 M857

2802. Pochvenni Institut Imeni V. V. Dokuchaeva. IMPROVEMENT OF SOIL FERTILITY BY DRAINAGE. (Rus) Moskva, 82 pp. 1956. 54 L542Z

2803. Poland, J. F., and Davis, G. H. SUBSIDENCE OF THE LAND SURFACE IN THE TULARE-WASCO (DELANO) AND LOS BANOS-KETTLEMAN CITY AREA, SAN JOAQUIN VALLEY, CALIFORNIA. Amer. Geophysical Union Trans. 37: 287-296. 1956. 330.9 Am3

Releveling of bench marks in 1953 and 1954 by the U.S. Coast and Geodetic Survey indicated that subsidence of the land surface has now exceeded ten feet in two areas of the San Joaquin Valley. In the Tulare-Wasco (or Delano) area of Tulare County, subsidence which was as much as five feet in 1940 now has about doubled. The maximum rate of subsidence in recent years has been about 0.8 foot a year. In the Los Banos-Kettleman City area of western Fresno County, major subsidence extends from Ora Loma on the north beyond Huron on the south. The maximum rate there approaches one foot a year.

2804. Ponnamperuma, F., Bradfield, R., and Peech, M. THE CHEMISTRY OF SUBMERGED SOILS IN RELATION TO THE GROWTH OF RICE. Cong. Internatl. Cong. de la Sci. du Sol. Rap. (B, colloque du Riz.): 6(C): 503-506. 1956. 56.09 In8452

A report was given on chemical factors of submerged soils in paddy fields in relation to the growth of rice.

2805. Pratt, P. F., Branson, R. L., and Chapman, H. D. EFFECT OF CROP, FERTILIZER, AND LEACHING ON CARBONATE PRECIPITATION AND SODIUM ACCUMULATION IN SOIL IRRIGATED WITH WATER CONTAINING BICARBONATE. Internatl. Cong. Soil Sci. Trans. 7(II): 185-192. 1960. 56.09 In847T

The data showed that the amount of leaching, the removal of Ca in harvested crops, the Ca added from fertilizers and soil amendments, and perhaps the type of crop were factors that influenced $CaCO_3$ precipitation in soils irrigated with water of a given HCO_3^--content. The data suggested that the differences resulting from different crops might be largely a result of differences in water removal which influence leaching losses.

The data from the lysimeters suggested that under conditions of no leaching and no Ca removal by crops, essentially all the Ca added would have been precipitated as $CaCO_3$, except for the Ca used in bringing the pH of the soil from the original slightly acid value to the point where precipitation of $CaCO_3$ was initiated.

2806. Prine, G. M., and West, S. H. A REVIEW OF PLANT AND WATER RELATIONS. Soil and Crop Sci. Soc. Fla. Proc. 19: 184-190. Ref. 1959. 56.9 So32

A review was given of twenty years of progress on plant and water relations in Florida. The effect of water control by irrigation and drainage was one of the topics discussed.

2807. Pyatetskii, G. E. PRODUCTIVITY OF DRAINED SWAMPS OF KARELIA. (Rus) Lesn. Khoz. 5: 9-13. May 1963. 99.8 L5622

2808. Qayyum, M. A., and Kemper, W. D. SALT-CONCENTRATION GRADIENTS IN SOILS AND THEIR EFFECTS ON MOISTURE MOVEMENT AND EVAPORATION. Soil Sci. 93: 333-342. 1962. 56.8 So3

A study to determine the effects of salt concentration gradients on the movement of moisture within a soil profile and evaporation from soil surfaces, two salts (NaCl and $CaCl_2$) were used, and five different moisture contents were maintained. In one case layers of salt were spread on the surface of soil columns and the soil sealed in lucite cylinders. After definite time periods the columns were cut up and analyzed for salt and moisture.

The data indicated a definite movement of moisture to the salt-bearing surface as diffusive flow at moisture contents less than one-half field capacity. Viscous flow, however, dominated at higher moisture contents.

2809. Quraishy, M. S. WATERLOGGING AS A FACTOR IN DEPRESSING CROP YIELD IN WEST PAKISTAN. Trade and Indus. 7(10): 1091-1094. Oct. 1963. 286.8 T674

A report was given on the need of drainage of irrigated lands in West Pakistan to improve crop production.

2810. Rankov, V. MICROBIOLOGICAL CHARACTERISTICS OF SOLONCHAK SOILS OF DRAINED NESEBAR MARSHES AND KARABOAZ LOWLAND. (Bu) Sofia. Tsent. Nauchnoizsled. Inst. po Pochvoznanie i Agrotekh. "Nikola Pushkarov." Izv. 4: 239-262. Ref. 1962. 56.9 So2
German summary.

2811. Rasmusson, G. THE DRAINAGE OF LAKE BOCKABOSJON: COMPARATIVE AIR PHOTO INTERPRETATIONS. (Sw) Sydsvenska Geog. Salisk. Svensk Geog. Arsb. 37: 163-189. maps. 1961. 502 L972
English summary.

A report was given on the comparison of air photos before and after the drainage of Lake Bockabosjon in Sweden.

2812. Rauser, W. E., and Crowle, W. L. SALT TOLERANCE OF RUSSIAN WILD RYEGRASS IN RELATION TO TALL WHEATGRASS AND SLENDER WHEATGRASS. Canad. J. Plant Sci. 43: 355-360. 1963.

Salt tolerance of Russian wild ryegrass was compared with that of tall wheatgrass and slender wheatgrass in controlled germination experiments and in a field trial. There appeared to be specific salt toxicity when Russian wild ryegrass was germinated in saline saturation soil extracts and sodium sulfate solutions. The absolute germination of this species was intermediate between that of tall wheatgrass and slender wheatgrass in the osmotic range up to 12.15 atmospheres. In the field, it was found that Russian wild ryegrass would establish, persist, and produce well in soil concentrations giving osmotic pressures up to 4.5 atmospheres (12 mmhos/cm. conductivity).

2813. Reddi, G. H. S., and Reddy, K. S. STUDY OF THE EFFECT OF BUNDING IN INCREASING CROP YIELD IN DRYLAND. Andhra Agr. J. 10(6): 202-206. 1963. 34.2 An4

A report was given on the effect of bunding (terracing) in increasing crop yields in dryland areas of India.

2814. Reemann, J. EFFECTS OF LEVELING ON THE YIELD OF WINTER GRAINS AND ON THE PHYSICAL PROPERTIES OF SODDY-GLEY SOILS OF ESTONIAN S.S.R. (Rus) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 24: 466-471. 1962. 106 Es83
German summary.

2815. Reeve, R. C. THE RELATION OF QUALITY OF WATER TO SOIL STRUCTURE. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 158-162. Jan. 1958. 55.9 C7693

Some of the major factors affecting soil structure were discussed and some of the recent findings of the U.S. Salinity Laboratory on this subject were presented.

Changes in soil structure due to the quality of the irrigation water were observed chiefly in: Changes in the rate of entry of water into the soil; changes in soil tilth; ease of cultivation; and ease of preparing the seed bed.

The major factors affecting the rate of water movement in soils were: (1) Total salt content of the irrigation water; (2) proportion of sodium salts in relation to the other salts in the water; and (3) exchangeable cation status of the soil.

2816. Repp, G. I., McAllister, D. R., and Wiebe, H. H. SALT RESISTANCE OF PROTOPLASM AS A TEST FOR THE SALT TOLERANCE OF AGRICULTURAL PLANTS. Agron. J. 51: 311-314. 1959. 4 Am 34P

The resistance of the protoplasm to various concentrations of sodium chloride was determined in combination with field experiments. The different species of plants had distinct differences in protoplasmic salt resistance and these agreed with field results and practical experience. Protoplasmic salt resistance can, therefore, be used as a test for predicting the salt tolerance of agricultural plants.

Measurements of the increases in leaf succulence on plants grown on salty soil were also in good agreement with the protoplasmic salt resistance and with yield.

2817. Resulovic, H. SOME PROBLEMS OF PSEUDOGLEY IMPROVEMENT IN BOSNIA AND HERZEGOVENIA. (Se) Agrohemija. 7: 428-437. Ref. 1964. 385 Ag87

2818. Reuss, J. O., and Campbell, R. E. RESTORING PRODUCTIVITY TO LEVELED LAND. Soil Sci. Soc. Amer. Proc. 25: 302-304. 1961. 56.9 So3

Field and greenhouse fertilizer tests on subsoils of the Yellowstone Valley which had been exposed by land leveling operations indicated that these subsoils are very deficient in N and P. This conclusion was substantiated by soil analyses. In the greenhouse, yields of barley on untreated subsoil were low, but excellent yields resulted when both N and P were supplied. Nitrogen alone was not effective. Excellent yields of corn were obtained in the field when adequate N and P were supplied or where heavy rates of manure were plowed down. Field response to N alone was good but generally less than that obtained by the combination. Phosphorus used alone did not increase crop yields. Neither physical properties nor minor elements were found to be limiting.

2819. Rhoades, E. D. GRASSES AND FLOOD SURVIVAL. Agr. Engin. 44: 22-23. 1963. 58.8 Ag83

An important project of the Soil Conservation Service's watershed protection program is the construction of detention reservoirs to temporarily trap water from heavy rains. When not flooded these detention areas furnish grassland for livestock. Prolonged spring rains in past years have killed many acres of native grasses in the detention pool areas of Texas, Oklahoma, and Kansas. Knowledge of the ability of selected grasses to survive temporary submergence help in selecting grasses for detention pool areas.

2820. Rhoades, E. D. INUNDATION TOLERANCE OF GRASSES IN FLOODED AREA. Trans. ASAE 7(2): 164-166, 169. 1964. 290.9 Am32T

The ability of grass to withstand given periods of submergence seemed to depend on plant physiology of the species. Some species were more tolerant to inundation than others; also, as the depth of flooding increased, the inundation tolerance decreased. Grasses were only slightly affected by submergence while semidormant. However, during the growing season they were injured in varying degrees by short periods of flooding.

In areas where adapted, grass species such as Bermudagrass, buffalograss, vinemesquite, prairie cordgrass, KSU lowland switchgrass, and common lowland switchgrass were recommended for establishment in the detention pool area where the expected inundation duration ranged up to 20 days. Caddo switchgrass and upland common switchgrass were recommended where the expected inundation ranged up to 15 days. Eastern gamagrass, alkali sacaton, El-Kan bluestem, KR bluestem, and weeping livegrass were recommended where the expected inundation duration ranged up to 5 days.

2821. Richard, F. THE INFLUENCE OF WATER-CONTENT AND AERATION IN SOIL ON THE GROWTH OF SPRUCE SEEDLINGS. (Ge) Schweiz. Anst. f. das Forstl. Versw. Mitt. 35(1): 243-264. Ref. 1959. 99.9 Sch92
English summary.

A report was given on the effect of soil structure-improvement and drainage on the effect of root and shoot growth of spruce seedlings in Switzerland.

2822. Richard, F., Chausson, J. S., and Suber, E. THE INFLUENCE OF SOIL MOISTURE TENSION AND SOIL STRUCTURE ON THE GROWTH OF SPRUCE SEEDLINGS. (Ge) Schweiz. Anst. f. das Forstl. Versw. Mitt. 34(1): 1-34. Ref. 1958. 99.9 Sch92
English summary.

The influence was discussed of soil moisture tension and soil structure on the germination and growth of spruce seedlings in Switzerland. The soil structure was modified by the use of Krillium.

2823. Richards, L. A. AGRICULTURAL USE OF WATER UNDER SALINE CONDITIONS. In THE FUTURE OF ARID LANDS. Amer. Assoc. Adv. Sci. P. 43: 211-225. 1956. 282.9 W58

A report was given on the use of irrigation water under saline soil conditions.

2824. Richards, L. A. AVAILABILITY OF WATER TO CROPS ON SALINE SOILS. U.S. Dept. Agr., Inform. B. 210, 10 pp. Nov. 1959. 1 Ag84Ab

A discussion was given of the availability of water to crops growing on saline soils.

2825. Richards, L. A., and Bower, C. A. SALT IN SOIL. U.S. Dept. Agr., Agr. Ybk. 1962: 202-208. 1962. 1 Ag84Y

A discussion was given of the salt problem in soils in the United States that are connected with irrigation practices.

2826. Robel, R. J. CHANGES IN SUBMERSED VEGETATION FOLLOWING A CHANGE IN WATER LEVEL. J. Wildlife Mangt. 26(2): 221-224. Ref. Apr. 1962. 410 J827

A report was given of the changes in submersed vegetation following a change of water level in a marsh in Utah.

2827. Robins, J. S., Nelson, C. E., and Domingo, C. E. SOME EFFECTS OF EXCESS WATER APPLICATION ON UTILIZATION OF APPLIED NITROGEN BY SUGAR BEETS. J. Amer. Soc. Sugar Beet Tech. 9(2): 180-188. July 1956. 66.9 Am35J

The effects were determined of application of excess irrigation water on utilization of nitrogen and the resulting effects upon sugar beet yields, sugar content, and nitrogen status. Application of irrigation water in excess of that storable in the root zone early in the growing season materially reduced sugar beet yields. Sugar content at harvest was considerably higher on treatments receiving early excess water applications than on the control irrigation treatments. The differences were greatest at high nitrogen rates.

2828. Rollins, M. B. WHAT IS THE QUALITY OF YOUR IRRIGATION WATER? Nev. Ranch and Home Rev. 2(8): 6-7. 1964. 60.18 Si12

During 1959-62, a cooperative study was made of the irrigation and drainage water quality of the Newlands Project surrounding Fallon, Nev.

Irrigation waters of the Newlands Project were generally of good quality. According to current USDA classification, the irrigation water, when drainage water was absent, had a medium salinity hazard and practically no sodium hazard. But the quality was substantially degraded when drainage waters containing large amounts of salts were diverted into the canals for irrigation reuse.

Drainage waters contained larger amounts of total salts with a higher percentage of sodium than irrigation waters. Drainage waters varied from a medium salinity and low sodium hazard to a very high salinity and very high sodium hazard.

2829. Rubtsov, V. G. EFFECT OF DRAINAGE ON FOREST REGENERATION IN THE SPHAGNUM PINE FORESTS. (Rus) Lesn. Khoz. 8(5): 16-18. May 1955. 99.8 L5622

2830. Rubtsov, V. G. DRAINAGE AS A MEANS OF ENSURING FOREST REGENERATION. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 49: 124-128. 1959. 99.9 Ak1

2831. Rubtsov, V. G. ENVIRONMENTAL FACTORS AFFECTING THE GERMINATION OF PINUS SYLVESTRIS SEEDS AND THE DEVELOPMENT OF SEEDLINGS IN SPHAGNUM PINE FORESTS AS RELATED TO DRAINAGE. (Rus) Bot. Zhur. [Moskva] 45(6): 896-900. June 1960. 451 R923

2832. Rubtsov, V. G. THE EFFECT OF DRAINAGE ON THE REGENERATION OF PINE. (Rus) Leningrad Nauch.-Issled. Inst. Lesn. Khoz. Sborn. Rabot po Lesn. Khoz. 4: 155-169. Ref. 1961. 99.9 L545

2833. Rubtsov, V. G. EFFECTIVENESS OF DRAINAGE GRASSY-SPHAGNUM PINE STANDS. (Rus) Lesn. Khoz. 9: 39-42. Sept. 1962. 99.8 L5622

2834. Rubtsov, V. G. AMELIORATIVE DRAINAGE AS A MEANS OF ENSURING REFORESTATION. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 129-134. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the effect of drainage for ensuring reforestation of swamped forests in the U.S.S.R. by natural and artifical plantings of spruce and pine.

2835. Ruiz Santaella, J. WATER AND SALINE SOILS. (Sp) Agricultura [Madrid] 31(366): 589-595. Ref. Oct. 1962. 15 Ag84

2836. Rumyantsev, G. T. CULTURE OF PINE ON DRAINED PEAT BOGS. (Rus) Lesn. Khoz. 1962(1): 33-34. Jan. 1962. 99.8 L5622

2837. Sabo, E. D. EFFECTIVENESS OF FOREST DRAINAGE MEASURES ON IMPROVEMENT OF POTENTIALLY RICH SOILS. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 36: 73-85. 1957. 99.9 Ak1

2838. Sabo, E. D. SOME RESULTS OF WORK ON RAISING PRODUCTIVITY OF BOGGED-OVER FORESTS BY MEANS OF DRAINAGE. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 49: 54-68. Ref. 1959. 99.9 Ak1

2839. Sabo, E. D. SOME RESULTS OF STUDIES OF THE DRAINAGE OF SPHAGNUM-PINE STANDS. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 53: 204-211. 1962. 99.9 Ak1

2840. Sabo, E. D. SOME RESULTS OF PROJECTS TO INCREASE PRODUCTIVITY OF SWAMPED FORESTS BY MEANS OF DRAINAGE. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 57-69. Ref. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the use of drainage in swamped forests in the U.S.S.R. to increase production.

2841. Sakovich, F. I., and Kalechits, N. P. UTILIZATION OF DRAINED LANDS IN BELORUSSIA. (Rus) Zemledelie. 5: 11-15. May 1963. 20 Z44

2842. Salvatore, M. SOIL WATERLOGGING. (It) Nuova Agr. Lucana. 6(12): 182-184. Dec. 1958. 16 N923

2843. Sandoval, F. M., Benz, L. C., George, E. J., and Mickelson, R. H. MICRORELIEF INFLUENCES IN A SALINE AREA OF GLACIAL LAKE AGASSIZ: I. ON SALINITY AND TREE GROWTH. Soil Sci. Soc. Amer. Proc. 28(2): 276-280. 1964. 56.9 So3

Considerable acreage of saline, imperfectly drained land in the northern Red River Valley of N. Dak. has a gently undulating microrelief or nearly level topography. In slight to moderate saline lands, the ridges are saline and the depressions relatively nonsaline. Salinity was studied in its relationship to microrelief under both shelterbelt and cultivated land use. Salinity in the ridge was composed primarily of magnesium and sodium sulfates. Exchangeable sodium was low and not a problem. Chemical compositions of shallow ground waters and saturation extracts of ambient soils were similar.

2844. Sandoval, F. M., Carlson, C. W., Mickelson, R. H., and Benz, L. EFFECTS OF RUNOFF PREVENTION AND LEACHING WATER ON A SALINE SOIL. Canad. J. Soil Sci. 41(2): 207-217. Aug. 1961. 56.8 C162

A 4-year study was conducted on the effects of precipitation management on salt movement and spring wheat yields on an imperfectly drained saline silt loam in North Dakota. Partial leaching by artificially applied water at the beginning of the experiment was compared with leaching benefits of impounded precipitation. Impounded precipitation was effective in partially desalinizing the soil. Summer rain was more effective than winter precipitation.

2845. Sarmah, K. C. DISEASES IN RELATION TO DRAINAGE. Tocklai Expt. Sta. Newslet. 6(4): 11-15. Dec. 1959. 68.18 T93

A report was given on the relation of diseases of tea to drainage conditions (waterlogging).

2846. Sarmah, K. C. DISEASES IN RELATION TO DRAINAGE. Tea Trade and Indus. 9(3): 111-114. Mar. 1960. 6818 T225

A report was given on the relation of lack of drainage to diseases of tea and other crops.

2847. Sastry, S. K. PROBLEM OF WATERLOGGING IN NIZAMSAGAR PROJECT AREA (ANDHRA PRADESH); A PRELIMINARY SURVEY. Andhra Agr. J. 7(4): 163-170. Ref. 1960. 34.2 An4

A report was given of a survey and classification of some waterlogged soils in India. The possible causes and effects of waterlogging were discussed and some suggestions for improving the areas were given.

2848. Satterlund, D. R., and Graham, S. A. EFFECT OF DRAINAGE ON TREE GROWTH IN STAGNANT SPHAGNUM BOGS. Mich. Forestry 19, 2 pp. Mar. 1957. 99.8 M58

The prompt removal of excess surface water from small stagnant spaghnum bogs showed a beneficial influence on the leader growth of black spruce and balsam fir saplings in a 7 year study. The acceleration of growth was prompt for black spruce, but was delayed several years for balsam fir. The extent of the area drained was increased with a marginal ditch that provided for water movement to a blasted ditch. There was a noticeable change of species composition of tree seedlings, shrubs, and herbs on the ditch banks, but not over the bog as a whole.

2849. Schaefer, R. ON THE NATURE AND DYNAMICS OF HUMIC ACIDS OF HYDROMORPHIC SOILS IN A DRAINAGE SUCCESSION. (Fr) Acad. d'Agr. de France Compt. Rend. 49(8): 578-581. Apr. 24/May 8, 1963. 14 P215Bc

2850. Schie, J. J. Van. DRAINAGE OF HORTICULTURAL LAND. (Du) Groenten en Fruit. 18(13): 519, 521. Oct. 3, 1962. 80 G89

2851. Schie, J. J. Van. DRAINAGE OF GARDEN SOIL. II. (Du) Groenten en Fruit. 18(14): 548-549. Oct. 10, 1962. 80 G89

2852. Schirmer. DRAINAGE AND SOIL TESTS. (Ge) Kuratorium f. Kultbauw. Jahresversamml. 1959: 14-17. 290.9 K96

2853. Schlaudt, E. A. WATER REGULATION FOR INCREASED TIMBER PRODUCTION. World Forestry Cong. Proc. 5(3): 1723-1727. 1960, pub. 1962. 99.9 C76912A

A report was given on the need and use of drainage and water control for wet pine sites in Southeastern United States. The increased growth of pond pine on the better drained sites was nearly double that on the poorly drained sites.

2854. Schwab, G. A., Kirkham, D., and Johnson, H. P. EFFECT OF TILE SPACING ON CROP YIELD AND WATER TABLE LEVEL IN A PLANOSOL SOIL. Soil Sci. Amer. Proc. 21(4): 448-452. July/Aug. 1957. 56.9 So3

Six years of data were presented on the effect of tile drainage in a Planosol soil (claypan soils of flat lands) at spacings of 15, 30, and 60 feet. Corn and oat yields on the 15- and 30-foot spacings varied from 3.4 to 9.1 bu. per acre higher than the yields on the 60-foot spacings.

2855. Scott, D. F. LET'S LOOK AT DRAINAGE. New Zeal. Dairy Exporter. 31(11): 35-36. May 1, 1956. 44.8 N484

A report was given on the value of drainage for dairy farms in New Zealand. Both open and closed drainage were discussed along with some "do's" and "don'ts" of drainage and misconceptions of drainage.

2856. Scott, R. S. THE EFFECT OF MOLE DRAINAGE AND WINTER PUGGING ON GRASSLAND PRODUCTION. New Zeal. Grassland Assoc. Proc. Conf. 25: 119-127. 1963. 60.19 N48

A report and the discussion were given on the effect of mole drainage on grassland production in New Zealand.

2857. Scott, R. S. LIMITED ADVANTAGES FROM DRAINAGE OF FOOTHILL COUNTRY. New Zeal. J. Agr. 109(1): 13-14. July 15, 1964. 23 N48J

A report was given on the value of tile and mole drainage of foothill pasture lands for winter grazing in New Zealand. It was concluded that drainage of these areas could be restricted to areas subject to drainage in winter from stock grazing or movements of animals or farm machinery.

2858. Sebbel, H. POLDERS AND DRAINAGE IN THE FRUIT GROWING REGION OF SOUTHWEST HOLSTEIN. (Ge) Erwerbsobstbau. 5(7): 121-122. July 1963. 80 Er9

2859. Servello, V. DRAINAGE AS FACTOR OF [SOIL] STRUCTURE AND FERTILITY. (It) Prog. Agr. [Bologna] 7(8): 995-997. Aug. 1961. 58.8 P94

2860. Shalhevet, J., and Zwerman, P. J. NITROGEN RESPONSE OF CORN UNDER VARIABLE CONDITION OF DRAINAGE—A PRELIMINARY GREENHOUSE STUDY. Soil Sci. 85(5): 255-260. Ref. May 1958. 56.8 So3

In a greenhouse study, the additional supply of nitrate to a water-logged soil substantially increased dry weight of tops and roots over and above that of the water-logged soil with no nitrogen. The increase in dry weight was close to that of plants growing in well-aerated soil.

2861. Shalhevet, J., and Zwerman, P. J. NITROGEN RESPONSE OF CORN UNDER VARIABLE CONDITIONS OF DRAINAGE—A LYSIMETER STUDY. Soil Sci. 93(3): 172-182. Ref. Mar. 1962. 56.8 So3

The importance of nitrogen deficiency in corn growing in poorly drained soil was determined and an investigation was made to see if nitrogen fertilization would affect the deterious effects of poor drainage. The investigation was limited to a lysimeter investigation.

2862. Shapiro, R. E. EFFECT OF FLOODING ON AVAILABILITY OF PHOSPHORUS AND NITROGEN. Soil Sci. 85(4): 190-197. 1958. 56.8 So3

Flooding increased the yield, phosphorus uptake, and nitrogen uptake by rice. These increases occurred with both a lowland (Colusa) and an upland (Korean) variety of saponica rice. Flooding increased the availability of soil phosphorus, but had no apparent effect on the availability of soil nitrogen. The applied phosphorus and nitrogen were both utilized more efficiently under flooded conditions.

2863. Shapiro, R. E. EFFECT OF ORGANIC MATTER AND FLOODING ON AVAILABILITY OF SOIL AND SYNTHETIC PHOSPHATES. Soil Sci. 85(5): 267-272. 1958. 56.8 So3

A report was given on the effect of organic matter and flooding on the availability of soil and synthetic phosphates for rice production.

2864. Shapiro, R. E., and Armiger, W. H. THE EFFECT OF FLOODING ON THE PLANT AVAILABILITY OF PHOSPHORUS FROM VARIOUS PHOSPHATE ROCKS. J. Agr. Food Chem. 6(6): 453-455. 1958. 381 J8223

The phosphate rocks tested under greenhouse conditions on a Cecil sandy loam and a Crosby silt loam fell into three plant-availability groups (60, 30, or 5 percent as plant available as resin phosphate), whether flooded or unflooded, when applied at the rate of 1 ton per acre. The effect of flooding on the plant availability of phosphate rock varied with the soil and the source of material. The relative plant availability of 10 phosphate sources was measured by four methods: Yield of plants; uptake of phosphorus; A values; and resin phosphate equivalents. The methods led to essentially the same groupings of the sources on the basis of phosphorus availability.

2865. Shavrgygin, P. I., and Sattarov, D. T. CONCENTRATION OF SALTS IN THE SOIL SOLUTION TOXIC FOR COTTON IN THE NEWLY IRRIGATED REGIONS OF GOLODNAYA STEPPE. (Rus) Pochvovedenie. 10: 117-126. Ref. Oct. 1964. 57.8 P34Ae
English translation—Soviet Soil Sci. 10: 1109-1117. Ref. Oct. 1964. 57.8 P34Ae

A discussion was given of the effect of the concentration of salts on its toxicity to cotton in a newly irrigated region in the U.S.S.R. The use of additional drainage was recommended for the area.

2866. Shelukhin, N. V. GROWING EUONYMUS EUROPAEUS ON THE DRAINED SWAMPS OF BELORUSSIAN SSR. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 31: 222-227. 1955. 99.9 Ak1

2867. Shiflet, T. N. PROFITABILITY OF RICE AND NATIVE GRASS ON A DEEP-PEAT FRESH WATER MARSH SOIL. J. Soil and Water Conserv. 18: 244-246. 1963. 56.8 J822

Range use of Class VII fresh water marshland in Louisiana was profitable even where it was necessary to control water levels by a system of levees and pumps. On the other hand, a rotation of rice farming and cattle was unprofitable due to relatively low rice yields and high production costs.

If fresh water marshes are drained and used for the production of crops, the peat soils will subside. This will cause the areas to become shallow lakes unless levees and pumps are used to control the water level.

The economic analysis given supports the present land capability classification of Fresh marsh, peat soils.

2868. Shimauchi, M., Ohashi, W., and Murayama, T. AN OUTLINE AND HISTORY OF THE BIBAI DEMONSTRATION FARM. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 115-151. Feb. 1956. 107.6 H68
English summary.

A report was given on the research in peat soil management (including drainage) on the Bibai Demonstration Farm in Japan.

2869. Shiratori, K., Matsumoto, N., and Matsuoka, Y. RESEARCHS ON THE TECHNICAL IMPROVEMENT OF RICE CULTURE ON ILL-DRAINED FIELDS. VI. STUDIES OF THE EFFECT OF HILL SOIL PUT ON RICE FIELDS. (Ja) Crop Sci. Soc. Japan Proc. 28(1): 55-57. Sept. 1959. 22.5 C88
English summary.

A study was reported on the benefits of the addition of red colored hill soil on muck, sandy soil, and heavy clay, poorly drained rice fields in Japan to improve drainage and crop growth.

2870. Shishkov, K. N. UTILIZATION OF DRAINED PEAT BOGS FOR AGRICULTURE. (Rus) Moskva Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury, 107 pp. 1955. 91 Sh64

2871. Shishkov, K. N., and Shishov, L. L. PHYSICAL PROPERTIES OF DRAINED SOILS OF THE YAKHROMA RIVER VALLEY. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 84: 132-138. 1963. 20 M857

2872. Shkinkis, T. N. INFLUENCE OF SOIL CONDITIONS ON HYDROLOGICAL EFFECT OF DRAINAGE. (Rus) Pochvovedenie. 1961(11): 98-103. Ref. Nov. 1961. 57.8 P34
German summary.
English translation—Soviet Soil Sci. 11: 1247-1251. Ref. Nov. 1951. 57.8 P34Ae

A report was given on the effect of soil conditions on the hydrological effect of drainage in Latvia.

2873. Shkinkis, T. N. MOISTURE REGULATION IN SOD-PODZOLIC SOIL BY DRAINAGE. (Rus) Pochvovedenie. 1962(4): 1-6. Ref. Apr. 1963. 57.8 P34
German summary.
English translation—Soviet Soil Sci. 4: 347-351. Apr. 1962. 57.8 P34Ae

A report was given of the use of drainage to regulate the moisture of soddy Podzolic soils in the U.S.S.R.

2874. Sieben, W. H. EFFECT OF DRAINAGE CONDITIONS OF THE SOIL ON NITROGEN SUPPLY AND YIELD. Landbouwkundig Tijdschrift. 76(20): 784-802. 1964. 105.2 Or3

A research report was given on the effect of drainage on crop growth on the Ijsselmeer polders in the Netherlands. Poor winter drainage degenerated soil structure, resulting in less mineralization of nitrogen. It was not possible to completely compensate for poor drainage by N-fertilization.

2875. Sims, J. R., and Dregne, H. E. FERTILIZER RESPONSE ON A SODIUM SOIL. N. Mex. Agr. Expt. Sta. Res. Rpt. 63, 6 pp. 1962. 100 N465R

A fertilizer experiment was conducted on a calcareous sodium soil, using different sources of nitrogen, phosphorus, and potassium in several different combinations, with and without added calcium. There was no response to nitrogen or calcium but there were significant responses to the nitrogen - phosphorus and nitrogen - phosphorus - potassium combination. The combination of potassium and phosphorus in potassium dihydrogen phosphate was much more effective than when superphosphate and two common forms of potash fertilizer were applied together. Muriate of potash produced higher yields than did the sulfate of potash.

2876. Sine, L. INFLUENCE OF LAND IMPROVEMENT ON THE PRODUCTIVITY OF SOILS. (Fr) Ann. de Gembloux. 69(3): 642-659. Third Q. 1963. 13 G28

2877. Skoropanov, S. G. SOIL DRAINAGE AND INTENSIFICATION OF AGRICULTURE IN NON-CHERNOZEM ZONE. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 11: 13-21. 1964. 20 V633

2878. Skov, K. S. COMPACTION AND DRAINAGE. (Da) Hedeselsk. Tidsskr. 82(3): 43-45. Mar. 10, 1961. 11 H35

2879. Skov, K. S. REDUCED DRAINAGE EFFECT ON CLAY SOILS. (Da) Hedeselsk. Tidsskr. 83(5): 93-98. Apr. 15, 1962. 11 H35

2880. Smith, J. H. INVESTIGATION OF THE SETTLING OF THE MARSHES ON NY JORD'S EXPERIMENTAL FARM, MOLSTAD IN DEOY. (No) Ny Jord. 45(1): 19 pp. 1958. 282.28 N98

2881. Smith, R. THE RELATIONSHIP BETWEEN WATER QUALITY AND DRAINAGE CHARACTERISTICS OF SOME IRAQ SOILS. Cong. Irrig. and Drain. Trans. 3(5): 10.1-10.26. Ref. 1957. 55.9 C7652

A report was given on the relationship between water quality and drainage characteristics of some Iraq soils. Land reclamation proposals for these soils included: Leaching; chemical amendments; drainage; and land levelling.

2882. Smoliak, L. P. FOREST REGENERATION ON DRAINED PEAT BOG SOILS IN POLESYE OF BELORUSSIAN SSR. (Rus) Akad. Nauk SSR. Inst. Lesa. Trudy. 31: 89-98. 1955. 99.9 Ak1

2883. Smolyak, L. P., and Boiko, A. V. PHYSICAL-CHEMICAL PROPERTIES OF SOILS OF RECLAIMED FOREST SWAMPS. (Rus) In Gomel'. Belaruski Navukova-Dasledchy Instytut Lyasnoi Gaspadarki. LESOVODSTVENNAYA NAUKA I PRAKTIKA, pp. 113-121. 1962. 99.45 G582

2884. Sommerkamp. PROBLEMS OF PASTURE HYGIENE ON PERMANENT GRASSLAND. (Ge) Praxis u Forsch. 12(4): 73, 75-76, 78. Apr. 21, 1960. 18 P89

2885. Sorteberg, A. SETTLING AND SHRINKING OF MARSHES. (No) Norske Myrselsk. Meddel. 56(3): 97-101. June 1958. 11 N813

2886. Sozykin, N. F. STUDIES OF THE NATIONAL FORESTRY AND FORESTRY MECHANIZATION RESEARCH INSTITUTE. (Rus) In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 91-96. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

Research by the National Forestry and Forestry Mechanization Research Institute and other institutions in the U.S.S.R. on forest drainage and forest drainage design was reported.

2887. Stein, M. PROBLEMS AND PROGRAMS IN WATER POLLUTION. Natural Resources J. 2(3): 388-415. 1962. 280.8 N19

A report on the problems and programs in water pollution in the various States of the United States was given.

In the 17 Western states, it was estimated that 92 percent of the water used is for irrigation and 3 percent is used by industry. In the 31 Eastern states, it was estimated that 81 percent of the water is used by industry and 3 percent for irrigation.

Objectives of a water policy for the individual states and the Nation are generally agreed to be: (1) The equitable apportionment of water among often conflicting demands; (2) the improvement of water quality; and (3) the stabilization of water flows and water supply.

2888. Stephens, J. C. SUBSIDENCE OF ORGANIC SOILS IN THE FLORIDA EVERGLADES. Soil Sci. Soc. Amer. Proc. 20: 77-80. Jan. 1956. 56.9 So3

An average subsidence rate of approximately 1-1/4 inches per year was found in peat and muck soils in the Everglades in a study that started in 1914. Water-table test plots showed that loss of peat soil depended directly upon the depth of drainage.

2889. Stephens, J. C. CAN WE SAVE OUR ORGANIC SOILS? Soil Conserv. 22(3): 54-59, 72. Oct. 1956. 1.6 So3S

A report was given on the use and misuse of organic soils in the United States.

2890. Stewart, F. B., and Lunin, J. SALT TOLERANCE OF AZALEAS AND CAMELLIAS. Veg. Growers News. 16(4): 3-4. 1961. 275.28 V52

A discussion was given on the effect of high tides and overfertilization of azaleas and camelias in tidewater areas. Research was reported on the effect of saline irrigation water on these plants in the greenhouse.

2891. Stewart, G. G. PRELIMINARY RESULTS OF EXPERIMENTS IN DRAIN DEEPENING IN TWO BORDER FORESTS. Great Brit. Forestry Comn. Rpt. Forest Res. 1958: 131-137. 1959. 99.9 G795Re

The effect of drains 9 inches deep were compared to those deepened to 24 inches in a peat area of border forests in Great Britian.

2892. Stinga, N. PRODUCTIVITY IMPROVEMENT OF THE MARSHY SOILS IN THE "TARA BIRSEI", IN RELATION TO THE DRAINAGE CONDITIONS. (Rum) Prob. Agr. [Bucharest] 15(7): 39-47. July 1963. 21 R862
English summary.

A report was given on the draining of marshy soil in the Tara Birsei area of Rumania.

2893. Stromberg, L. WATER QUALITY AND FARM MANAGEMENT. Conf. On Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 89-94. Jan. 1958. 55.9 C7693

The use of water of marginal quality in sprinkler irrigation areas should be investigated more thoroughly. The problem is an added concentration of salts in the water from evaporation between the sprinkler head and the soil surface.

One of the obvious problems of poor-quality water is the selection of crops.

An irrigator can do very little to combat boron in water. He must live with it by carefully choosing only tolerant crops, and so irrigate that borates, which are quite soluble in water, will not accumulate in the soil.

2894. Sultanov, Y. G. CHANGE OF SALT CONTENT IN SOILS OF SALYANYSTEPPE THROUGH IRRIGATION AND DRAINAGE WORKS. (Rus) Akad. Nauk Azerb. SSR. Dok. 19(6): 59-62. 1963. 511 Ak147D

2895. Sumarjono, M., and Redjoagung, S. F. THE IMPORTANCE OF SOIL AERATION IN SUGAR CANE CULTIVATION IN JAVA. Sugar J. 23(12): 24-25, 27-29. May 1961. 65.8 Su391

A report was given on the importance of soil aeration by tillage and drainage for sugarcane production following rice in fields of Java.

2896. Sutton, J. G. DAMAGE TO LANDS BY SEEPAGE. In PROCEEDINGS SEEPAGE SYMPOSIUM PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-90: 22-30. Ref. Jan. 1965. A56.9 R31

A report was given on the damage to land by seepage from canals, reservoirs, and farm ponds where there is opportunity to reduce damage by linings, relief drains, or interceptor drains.

2897. Sylvester, R. O., and Seabloom, R. W. QUALITY AND SIGNIFICANCE OF IRRIGATION RETURN FLOW. Amer. Soc. Civil Engin. Trans. 129: 460-462. 1964. 290.0 Am3

A digest was given on an article on the quality and significance of irrigation return flow. The original article was published in the J. Irrig. and Drain. Div., ASAE 89(IR 3): 1-27. Sept. 1963.

2898. Takijima, Y. STUDIES ON SOILS OF PEATY PADDY FIELDS. IX. CHANGES IN SOIL PROPERTIES BY WATER PERCOLATION AND SOIL DRYING. (Ja) J. Sci. Soil and Manure. 30(2): 71-74. 1959. 56.8 J27
English abstract—Soil and Plant Food. 5(1): 43. June 1959. 56.8 So38

Studies in Japan were reported on the changes of soil properties of peaty paddy fields by water percolation and soil drying.

2899. Takijima, Y. STUDIES ON SOILS OF PEATY PADDY FIELDS: XIII. EFFECTS OF SOIL DRAINAGE ON GROWTH OF RICE PLANT AND CHANGE OF WEED ASSOCIATION. (Ja) J. Sci. Soil and Manure. 30(6): 259-262. 1959. 56.8 J27
English abstract—Soil and Plant Food. 5(3): 147. Dec. 1959. 56.8 So38

Studies in Japan were reported on the effects of soil drainage of peaty paddy fields on rice plants and their weed associations.

2900. Takijima, Y. STUDIES ON SOILS OF PEATY PADDY FIELDS: XVIII. EFFECTS OF SOIL WASHING AND DRAINAGE ON THE INITIAL GROWTH OF RICE PLANTS. (Ja) Sci. Soil and Manure. 30(1): 521-559. 1960. 56.8 J27
English abstract—Soil and Plant Food. 6(1): 44. Sept. 1960. 56.8 So38

Studies in Japan were reported on the effect of leaching the soil with water several times and drainage before and after transplanting rice seedlings into peaty paddy fields.

2901. Takijima, Y., and Konno, K. STUDIES ON SOILS OF PEATY PADDY FIELDS. XIV. EFFECTS OF DRAINAGE ON METABOLISM AND ELUVATION OF SOIL CONSTITUENTS. (Ja) Sci. Soil and Manure. 30(7): 341-343. 1959. 56.8 J27
English abstract—Soil and Plant Food. 5(3): 150. Dec. 1959. 56.8 So38

Studies in Japan were reported on the effect of drainage of peaty paddy fields on soil metabolism.

2902. Takijima, Y., and Konno, K. STUDIES OF SOILS OF PEATY PADDY FIELDS: XV. INFLUENCE OF THE TIME OF DRAINAGE ON GROWTH OF RICE PLANT, METABOLISM AND ELUVIATION OF SOIL CONSTITUENTS. (Ja) J. Sci. Soil and Manure. 30(8): 381-384. 1959. 56.8 J27
English abstract—Soil and Plant Food. 5(4): 194. Mar. 1960. 56.8 So38

Studies in Japan were reported on the influence of the time of drainage of peaty paddy fields on the growth of the rice plant, soil metabolism, and eluviation of soil constituents.

2903. Tanaka, I. ON THE RELATION BETWEEN RICE BLAST OUTBREAK AND SOIL CONDITIONS, ESPECIALLY WITH RESPECT TO PEAT SOILS OF PADDY FIELDS. (Ja) Hokkaido Natl. Agr. Expt. Sta. B. 69: 103-114. Feb. 1956. 107.6 H68

A report was given on the relation between rice blast and drainage of the soil, especially on peat soils and heavy clay soils in Japan.

2904. Tateoka, R. ON THE DENATURATION OF PADDY FIELD SOILS DERIVED FROM THE DRYING PROCESS OF LOWLAND WET PADDY FIELDS. I. (Ja) Tottori Soc. Agr. Sci. Trans. 11(2): 94-98. Mar. 1957. 513 T64
English summary.

The change of properties of soils of paddy fields in Japan was studied after the soils were drained by subsurface drainage.

2905. Tateoka, R. EFFECTS OF UNDERDRAINAGE IN LOWLAND POORLY DRAINED PADDY FIELD. Soil and Plant Food. 3(2): 80-84. Oct. 1957. 56.8 So38

The physical and chemical properties of soils from lowland poorly drained paddy fields were compared with these properties from an adjoining better drained paddy field with a longer rotation between rice crops.

The results suggested that humosilicate complexes formed with the stabilization of soil humus and the amorphous clay minerals crystalized during the course of the soil drying process of the lowland poorly drained fields.

2906. Taylor, G. S., and Goins, T. CHARACTERISTICS OF WATER REMOVAL IN A TILE-DRAINED HUMIC-GLEY SOIL. Soil Sci. Soc. Amer. Proc. 21(6): 575-580. Nov./Dec. 1957. 56.9 So3

A water table was established within a few inches of the ground surface on a tile-drained Humic-Gley soil (Toledo silty clay loam). Measurements of water-table levels were made at various time intervals until the area was drained. The characteristics of the drawdown were discussed.

2907. Teipel, R. MELIORATION OF HEAVY SOILS. (Ge) Deut. Landwirt. 9(5): 228-233. Ref. May 1958. 18 D4822

2908. Thenabadu, M. W. CHARACTERISTICS OF AN ILL-DRAINED RICE SOIL PROFILE IN BOMBUWELA. Trop. Agr. [Peradeniya] 116(4): 267-272. Oct./Dec. 1960. 26 T751

Physical and chemical characteristics were given of a poorly drained rice soil in Ceylon.

2909. Thomas, F. H. THE EFFECT OF DEPTH OF WATER TABLE ON GROWTH AND CHEMICAL COMPOSITION OF OAT FORAGE AND FIELD CORN. Soil and Crop Sci. Soc. Fla. Proc. 22: 73-78. Ref. 1962, pub. 1963. 56.9 So32

A report was given on the effect of depth of water table on organic soils in Florida on oats and corn.

2910. Thorne, J. P., and Rickenbach, R. G. THE PROBLEM OF SALTY IRRIGATION WATER. Farm and Home Sci. [Utah Sta.] 22(3): 76-78. Sept. 1961. 100 Ut1F

A report was given on the problems connected with the use of salty irrigation water in Utah.

2911. Thurmann-Moe, P. EFFECTIVE DRAINAGE ON FERTILIZER FIELDS. (No) Norsk Skogbruk. 7(1): 5-8. Jan. 1961. 99.8 N815

2912. Timofeev, A. F. SOME PROBLEMS CONNECTED WITH THE EFFECTIVENESS OF FOREST RECLAMATION BY DRAINAGE. (Rus) Belorusskaia Sel'skokhoz. Akad. Trudy. 30(1): 94-102. Ref. 1959. 106 B415

2913. Tipuri, V. SETTLING OF BOG LAND. (Sw) Nord. Jordbrforsk. 39(1/2): 140-141. 1957. 11 N752
Discussion, pp. 141-145.

2914. Tiulenev, N. A. ROLE OF AERATION DRAINAGE IN IMPROVING THE QUALITY OF THE GRASS STAND ON MEADOWS WITH PEAT SOILS. (Rus) Vsesoiuzn. Akad. Sel'skokhoz. Nauk im. V. I. Lenina. Dok. 21(3): 43-47. 1956. 20 Ak1

2915. Tokyo University, College of Agriculture, Laboratory of Agriculture Economics. LONG RANGE EFFECT OF AGRICULTURAL WATER UTILIZATION, FUKUSHIMA PREF. ASAKA DRAINAGE AREA, KAMIYA, KEIJI. (Ja) Tokyo, 136 pp. 1956. 54 T57

A report was given on the long range effect of agricultural water utilization in a drainage area of Japan.

2916. Tonini, G. THE DRAINAGE OF PLAIN SOILS, THE CULTURE OF GRAPES ON STAKES OR SPECIALIZED TALL ARBORS. I.-II. (It) Romagna Agr. e Zootec. 42(2): 37-55; Feb. 1957, and 42(3): 81-108. Mar. 1957. 16 R66

2917. Touwen, L., and Versteeg, W. SPORTFIELDS. (Du) Nederland. Heidemaatsch. Tijdschr. 75(6): 295-302. June 1964. 12 N282.

2918. Tovey, R. CONSUMPTIVE USE AND YIELD OF ALFALFA GROWN IN THE PRESENCE OF STATIC WATER TABLES. Nevada Agr. Expt. Sta. Tech. B. 232, 65 pp. 1963. 100 N41S

A technical report was given on the consumptive use of water and yield of alfalfa grown in the presence of static water in a lysimeter.

2919. Tovey, R. WATER TABLE FLUCTUATION—EFFECT ON ALFALFA PRODUCTION. N. Mex. Agr. Expt. Sta. Tech. B. 1, 11 pp. 1964. 100 N465

Design criteria for surface irrigation, subirrigation, and drainage require information on the duration of waterlogging or flooding tolerated by crops. The results of research concerned with the effects of fluctuating water tables on the yield and growth stage of alfalfa were given.

2920. Tovey, R. ALFALFA GROWTH AS INFLUENCED BY STATIC AND FLUCTUATING WATER TABLES. Amer. Soc. Agr. Engin. Trans., ASAE 7(3): 300-312. 1964. 290.9 Am32T

A report was given on a lysimeter study in Nevada of the effect of static and fluctuating water tables on alfalfa growth.

2921. Townsend, L. R., and MacKay, D. C. THE EFFECT OF CROPPING ON SOME CHEMICAL PROPERTIES OF A SPHAGNUM PEAT SOIL. Canad. J. Soil Sci. 43: 171-177. 1963. 56.8 J822

Chemical analysis, including a conventional scheme of proximate analysis as well as pretreatment with 0.1 N hydrochloric acid, were used to assess changes occurring in the chemical properties of a strongly acid sphagnum peat when it was limed, fertilized, and cropped for 3- and 5-year periods. Pretreatment was necessary to remove the large quantities of added fertilizer and limestone which were found to neutralize substantial amounts of the hydrochloric acid required for the hydrolysis of hemicellulose.

2922. Trappel, A. WATER ECONOMY IN DRAINED, HEAVY SOILS. (Ge) Oesterr. Wasserwirt. 7: 69-75. Apr. 1955. 55.8 Oe8

2923. Trevijano Molina, S. PROBLEMS IN IRRIGATION AND DRAINAGE. (Fr) Cong. Irrig. and Drain. Trans. 4(3): 11.493-11.506. 1960. 55.9 C7652
English summary.

A report was given on problems of irrigation and drainage in Spain and the effects of drainage on soils.

2924. Triplett, G. B., and Van Doren, D. M. DEVELOPMENT OF A DRAINAGE VARIABLE FACILITY FOR SOIL AND CROP MANAGEMENT STUDIES ON A LAKEBED CLAY SOIL. I. ESTABLISHMENT OF DRAINAGE TREATMENTS AND THEIR PRELIMINARY EFFECT ON CROP YIELD. Ohio Agr. Expt. Sta. Res. C. 117, 25 pp. Ref. May 1963. 100 Oh3R

A report was given on the need of land forming to reduce the variabilities in an experiment involving no drainage and tile drainage on a labeled clay soil in Ohio.

2925. Trizno, S. I., and Ziul'kov, G. I. EFFECT OF GROUND WATER LEVELS IN PEAT BOG SOILS ON YIELDS OF CORN. (Rus) In KUKURUZA V BSSR; SBORNIK STATEI. Minsk, Akademiia Nauk Belorusskoi SSR, pp. 335-339. 1957. 59.22 K953

2926. Truss, P. S. EXPERIMENT IN ACCELERATED PREPARATION OF DRAINED MARSHES FOR FORAGE CROP ROTATIONS. (Rus) Zhivotnovodstvo. 8: 108-110. Aug. 1955. 49 Z6

2927. Ubing, W. S. RELATION BETWEEN GROUND AND DITCH WATER STANDS IN LOW-LYING GRASSLAND DISTRICTS OF LOPIKERWAARD (S. W. UTRECHT) WITH SOIL PROFILES OF CLAY ON PEAT. (Du) Landbk. Tijdschr. 75(19): 992-1004. Ref. Nov. 1963. 105.2 Or3

2928. Uchiyama, N., and Onikura, Y. SOME CONSIDERATIONS ON PROFILE INVESTIGATIONS OF PADDY SOILS. Cong. Internatl. de la Sci du Sol. Rap. 6(C, colloque du Riz): 493-497. 1956. 56.09 In8452

A discussion was given on some soil profile investigations of paddy fields in Japan.

2929. Uiska, Y. RECIPROCAL INFLUENCE BETWEEN HYDRAULIC REGIME AND WATER PROPERTIES OF DRAINED SOILS. (Rus) Int. Congr. Soil Sci. Pap. 8: 45-63. Ref. 1964. 56.09 In848Do
English summary.

A report was given on the reciprocal influence between hydraulic regime and water properties of drained soils in the U.S.S.R.

2930. Umback, C. R., Fine, L. O., and Wiersma, F. THE EFFECTS OF IRRIGATING SOILS OF THE PROPOSED SHADEHILL PROJECT WITH WATERS HIGH IN SODIUM AND BICARBONATE IONS. S. Dak. Acad. Sci. 38: 88-95. 1959. 500 So82

The effect of the application of low-quality water from Shadehill Reservoir upon the accumulation of salts and alkali in soils typical of the proposed Shadehill Irrigation Unit in South Dakota was studied. It appears that exchangeable sodium percentages are in equilibrium with the water being applied (at least in the upper portions of the soil profile) and that these equilibria are reached at levels somewhat lower than those predicted by the SAR-ESP nomograph. Under the conditions of annual rainfall found at this location (about 15 inches per year), the "residual Na_2CO_3" content of the water has not, under field conditions, induced further increases in exchangeable Na beyond those levels otherwise anticipated.

2931. U.S. Agriculture Research Service. USE OF BRACKISH WATER. U.S. Dept. Agr., Agr. Res. 8(6): 15. 1959. 1.98 Ag84

Many crops can be saved during droughts by irrigation with brackish water in coastal areas where the sea has flooded into surface water sources or infiltrated wells. Brackish water is usable for crop production when it's a tenth to an eighth as salty as sea water.

Virginia studies showed an accumulation of salts in the top 6 to 12 inches of soil where brackish water had been used, but the following winter's rains usually washed them out.

2932. U.S. Regional Salinity Laboratory, Riverside, California. SALT PROBLEMS IN IRRIGATED SOILS. U.S. Dept. Agr., Agr. Inform. B. 190, 12 pp. Aug. 1958. 1 Ag84Ab

A discussion was given of the salt problems in irrigated soils. Proper drainage was stressed. Methods of improving saline soils by leaching and sodic soils by chemical amendments plus leaching were given.

2933. Uttar Pradesh. Information Department. RIDDANCE FROM UNWELCOME WATER. Lucknow, 16 pp. 1958. 54 Ut8

A report was given on the need and use of drainage in Uttar Pradesh in India.

2934. Vaksman, E. G., and Saidov, A. S. EFFECTIVENESS OF A DRAINAGE SYSTEM ON THE KARALANGSKII EXPERIMENTAL-RECLAMATION PLOT. (Rus) Akad. Nauk Tadzhikskoi SSR. Dok. 4(6): 35-40. 1961. 511 Ak193D

2935. Valk, G. G. M. Van Der. GROUND-WATER LEVEL EXPERIMENTAL FIELD OUDKARSPEL. (Du) Netherlands Dir. van de Tuinbouw. Meded. 24(5): 313-317. May 1961. 86 N384
English summary, pp. 330.

A report was given on some experiments on the effect of ground water levels on vegetable crops in the Netherlands. Both irrigation and drainage was controlled from the same ditch.

2936. Van Der Elst, F. C. C. H. THE DANGER OF OVERDRAINING PEAT SOILS. New Zealand J. Agr. 94(5): 511-512. May 15, 1957. 23 N48J

The management of peat soils were given for New Zealand.. Problems due to overdraining were described and illustrated. Many shallow drains proved better than a few deep drains.

2937. Van Doren, D. M. $40 BONUS FOR TILING CORN. Ohio Farm and Home Res. 44(318): 45. May/June 1959. 100 Oh3S

A report was given on the increased crop production on a tile drained corn field in Ohio during a wet year.

2938. Van Doren, D. M., and Triplett, G. B., Jr. NEED FOR TILE DRAINAGE BEING STUDIED. Ohio Farm and Home Res. 48(3): 46-47. May/June 1963. 100 Oh3S

A report was given on the effectiveness of tiling compared with land leveling or land forming in Ohio.

2939. Hoorn, J. W. van. Results of a ground water level experimental field with arable crops on clay soil. 'Netherlands J. Agr. Sci. 6: 1-10. 1958. 12 N3892

A report was given on the results of a shallow ground water level on an experimental field on a heavy clay soil in the Netherlands.

2940. van't Woudt, B. D., and Hagan, R. M. CROP RESPONSES AT EXCESSIVELY HIGH SOIL MOISTURE LEVELS. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 514-578. 1957. 4 Am392

A review of the literature was given on the crop responses at excessively high soil moisture levels. The following subjects were discussed: (1) Physical and chemical processes in waterlogged soils; (2) physical behavior of plants growing on waterlogged soils; (3) damage to crops by flooding; (4) crop response at high water tables; (5) crop quality as affected by high soil moisture; (6) crop yields on drained and undrained lands; and (7) summary.

2941. Vidal, H. COMPARATIVE OBSERVATIONS ON WATER BALANCE AND CLIMATE ON UNCULTIVATED AND CULTIVATED HIGH PEAT BOGS IN SOUTHERN BAVARIA. II. RESULTS OF COMPARATIVE INVESTIGATIONS ON THE RUNOFF AND GROUND WATER RELATIONS AND THE WATER BALANCE OF AN UNTOUCHED OR DRAINED AND CULTIVATED BOG IN THE FOOTHILLS OF THE ALPS (WITH SPECIAL ATTENTION TO THE DRAINAGE YEAR 1959). (Ge) Mitt. f. Landkult. Moor- u. Torfwirt. 8(2/3): 50-107. Ref. June/Sept. 1960. 60.1 M69
English summary.

Results were given of comparative investigations of the runoff, ground water relations, and the water balance of undrained high peat bogs and drained-cultivated high peat bogs in Southern Bavaria.

2942. Vidal, H. THE INFLUENCE OF RECLAMATION METHODS ON THE WATER ECONOMY AND CLIMATE OF HIGH MOORS. (Ge) Bayer. Landwirt. Jahrb. 38(1): 65-77. 1961. 18 L24

2943. Vidal, H. RESULTS OF COMPARATIVE DRAINAGE AND GROUND WATER OBSERVATIONS ON AN UNTOUCHED AND CULTIVATED HIGH MOOR AREA IN THE SOUTHERN CHIEMSEE MOORS IN THE DRAINAGE YEAR 1960. (Ge) Bayer. Landwirt. Jahrb. 38(6): 701-717. 1961. 18 L24

2944. Viilberg, K. K. ON IMPORTANCE OF THE LEVEL OF GROUND WATERS IN PEAT BOG SOIL. (Rus) Kartofel' 2(3): 37. May/June 1957. 75.8 K147

2945. Volik, V. THE EFFECTIVE STRUCTURE OF PLANTED AREAS AS A MEANS TO INCREASE PRODUCTIVENESS OF DRAINED LANDS. (Rus) Ekon. Sel'sk. Khoz. 2: 86-93. Feb. 1964. 281.8 So73

2946. Volik, V. F. WAYS OF INCREASING THE EFFECTIVENESS OF THE CULTIVATION OF CORN ON DRAINED LANDS. (Rus) Gidrotekh. i Melior. 6: 9-14. June 1963. 290.8 G362

2947. Volkovskii, P. A. EFFECTIVENESS OF DRAINAGE SYSTEM REESTABLISHED ACCORDING TO SIMPLIFIED PROJECTS IN WESTER [WESTERN] REGION OF UKRAINIAN SSR. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 46: 144-159. map. 1962. 106 P44
English summary.

2948. Volobuyev, V. R. GENERAL PATTERN OF CHANGES IN THE SALT CONTENT OF IRRIGATED AND MELIORATED SOILS. (Rus) Pochvovedenie. 5: 47-56. Ref. May 1964. 57.8 P34
English Summary.
English translation—Soviet Soil Sci. 5: 483-489. Ref. May 1964. 57.8 P34Ae

A discussion was given of the changes of salt content of irrigated soils in the U.S.S.R. after drainage and leaching.

2949. Vomperskii, S. E. EFFECTIVENESS OF FOREST-DRAINAGE IN CONNECTION WITH QUALITY OF PEAT SOILS. (Rus) Akad. Naul SSSR. Inst. Lesa. Trudy. 49: 101-102. 1959. 99.9 Akl

2950. Vomperskii, S. E. MORPHOLOGY OF PINE ROOT SYSTEMS IN DRAINED SWAMPS. (Rus) In Akademiya Nauk SSSR. Laboratoriya Lesovedeniya. NOVYE LESOVODSTVENNYE ISSLEDOVANIYA. Moskva, pp. 62-65. 1960. 99.34 Ak12

2951. Vomperskii, S. E. BENEFITS OF FOREST DRAINAGE WITH SPECIAL REFERENCE TO QUALITY OF PEATY SOILS. In P'yavachenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 103-105. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the benefits of forest drainage on peat soils, microorganisms, and trees in the U.S.S.R.

2952. Voznyuk, S. T., Korobchenko, V. T., and Skochinskaya, N. N. CHANGE IN THE PROPERTIES OI RECLAIMED PEAT SOILS OF POLESYE AND THE FOREST-STEPPE OF THE UKRAINIAN SSR UNDER THE EFFECT OF AGRICULTURAL EXPLORTATION. (Rus) Pochvovedenie 1: 19-28. Ref. Jan. 1964. 57.8 P34
English translation—Soviet Soil Sci. 1: 12-18. Ref. Jan. 1964. 57.8 P34Ae

A report was given of the effect of drainage and farming practices on peat soils in the U.S.S.R.

2953. Wadleigh, C. H., Wilcox, L. V., and Gallatin, M. H. QUALITY OF IRRIGATION WATER. J. Soil and Water Conserv. 11: 31-33. 1956. 56.8 J823

The quality of irrigation water is determined by: (1) The kinds of dissolved salts; (2) the relative proportions of certain ions; and (3) the total concentration.

All naturally occurring ground waters contain chloride, sulfate, and bicarbonate salts of calcium, sodium, and magnesium. The concentration of these various ions may vary from a fraction of a part to several thousand p.p.m. Potassium, nitrate, fluoride, carbonate, iron, and boron may also be present in small amounts in waters used for irrigation. Almost any ion present in irrigation water at relatively high concentration can be toxic to crop plants.

2954. Walker, L. C. THE EFFECTS OF WATER AND FERTILIZER ON LOBLOLLY AND SLASH PINE SEEDLINGS. Soil Sci. Soc. Amer. Proc. 26(2): 197-200. Mar./Apr. 1962. 56.9 So3

A report was given on the effect of drainage, permanent flooding, and fertilizer on loblolly and slash pine seedlings.

2955. Walker, L. C., and Green, R. L. DRAINING PINE FORESTS. Forest Farmer. 20(6): 8-9, 14, 19. Mar. 1961. 99.8 F7692

A report was given on the effect of drainage on pine forests in Southeastern United States.

2956. Walker, L. C., Green, R. L., and Daniels, J. M. FLOODING AND DRAINAGE EFFECTS ON SLASH PINE AND LOBLOLLY PINE SEEDLINGS. Forest Sci. 7(1): 2-15. Ref. Mar. 1961. 99.8 F7632

A report was given on the effect of flooding and drainage on slash pine and loblolly seedlings in Georgia.

2957. Wang, C. C., Liu, T. C., Wu, T. Y., and Yu, C. OPINIONS ON THE IMPROVEMENT AND USE OF FLOODED SALINE AND ALKALINE SOILS OF THE CHING-HAI YUN-TUNG AREA. (Ch) Turang Tongbao. 4: 12-16. Aug. 1963. 56.8 T792

2958. Watanabe, K. ON RESULTS BROUGHT ABOUT BY LAND IMPROVEMENT ENTERPRISES EXECUTED IN LOW-LYING AREAS AND DEVELOPMENT FARMING MANAGEMENT. Cong. Irrig. and Drain. Trans. 4(3): 11.565-11.575. map. 1960. 55.9 C7652

A report was given on the value of drainage in an area in Japan.

2959. Watts, D. G. RESULTS OF A DRAINAGE INVESTIGATION ON A SOIL OF THE WOODBURN SERIES. Oreg. Agr. Expt. Sta. Spec. Rpt. 162, 25 pp. Sept. 1963. 100 Or3M

The results were given of a performance rating of a tile drainage system on Woodburn soils in Oregon.

2960. Wecksten, P. TT—ASSURED TIMBER PRODUCTION—DRAINAGE OF PEAT LAND. (Sw) Skogsbruket. 33(9): 230-231. 1963. 99.8 Sk59

2961. Wiklander, L. NUTRIENT CONTENTS OF DRAINAGE WATER. (Sw) Grundforbattring. 12(4): 193-210. 1959. 54.8 G92

2962. Wiklander, L., and Hallgren, G. LEACHING OF NUTRIENTS FROM DRAINED SOILS. (Sw) Grundforbattring. 13(2): 71-77. 1960. 54.8 G92

2963. Wilcox, J. C., Holland, W. D., and McDougald, J. M. RELATION OF ELEVATION OF A MOUNTAIN STREAM TO REACTION AND SALT CONTENT OF WATER AND SOIL. Canada J. Soil Sci. 37: 11-20. 1957 56.8 C162

Water samples were obtained from a number of mountain lakes and irrigation reservoirs in the Okanagan Valley, and from streams emptying them. It was found that in any one drainage basin, the water had a higher pH and salt content at low elevation than at high elevation.

A more detailed investigation was conducted in the Mission Creek watershed. With decreasing elevation the following relationships were found: (1) Increasing pH, electrical conductivity, and contents of calcium, potassium, and sodium in the stream water; (2) increasing pH and conductivity in sspage water; and (3) increasing pH and conductivity in the soil. Relationships between elevation and pH were similar with stream water, seepage water and soil, as also were relationships between elevation and conductivity values.

2964. Wilcox, L. V. ANALYSES OF SALT BALANCE AND SALT-BURDEN DATA ON THE RIO GRANDE. Symposium on Problems of the Rio Grande—an Arid Zone River, N. Mex. State Engin. Off. Mar. 1957, pp. 39-44. 1957.

A report was given on the salt balance and salt-burden data on the Rio Grande river in New Mexico.

2965. Wilcox, L. V. DETERMINING THE QUALITY OF IRRIGATION WATER. U.S. Dept. Agr., Agr. Inform. B. 197, 6 pp. 1958. 1 Ag84Ab

The quality of an irrigation water depends upon the kind and amount of salts that are dissolved in it. A chemical analysis will show what salts are present and in what amount. From such an analysis, it is possible to decide on the suitability of the water for irrigation use.

The following points were discussed: (1) The characteristics of an irrigation water that determine its quality; (2) the type of water analysis required; and (3) ways to judge quality from the water analysis.

2966. Wilcox, L. V. WATER-QUALITY CRITERIA. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 40-45. Jan. 1958. 55.9 C7693

The characteristics of an irrigation water that determine its quality are: Total concentration of dissolved constituents; sodium concentration; concentration of boron or other toxic substances; and bicarbonate content.

A satisfactory appraisal of the quality of a water for irrigation use can be made if these four criteria are known and properly interpreted. The success in the use of the water, however, will depend on such factors as drainage, leaching, rainfall, salt tolerance of crops, and management practices. Of these, drainage is by far the most important.

2967. Wilcox, L. V. WATER QUALITY FROM THE STANDPOINT OF IRRIGATION. Amer. Water Works Assoc. J. 50(5): 650-654. 1958. 292.9 Am32J

A report was given on the effect of saline irrigation water quality on crops and soils.

2968. Willardson, L. S. LAJAS VALLEY DRAINAGE PROBLEMS. Puerto Rico (Rio Piedras) Agr. Expt. Sta. B. 143, 64 pp. maps. Ref. July 1958. 100 P83

A report was made on the drainage research in progress in the Lajas Valley of Southwestern Puerto Rico. Methods and materials were noted which were related to investigations with piezometers, water-table wells, drainage wells, tile drains, mole drains, plastic tube drains, core-drilling machines, and well drillers. Results of drainage and reclamations were given for shallow, closely spaced tile drains.

2969. Willardson, L. S. WATER RESOURCE DEVELOPMENT AND AGRICULTURE. Utah Mosquito Abatement Assoc. Proc. Annu. 17: 6-8. Mar. 1964. 420 Utl

A discussion was given on the relationship between water resource development and agriculture in Utah. Higher efficiency of irrigation water would provide a double benefit—more available water and fewer mosquitoes.

2970. Willets, D. B. WATER QUALITY CONSIDERATIONS IN SOUTHERN CALIFORNIA. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 68-75. Jan. 1958. 55.9 C7693

The most acute and highly important water-quality problems center on the protection of valuable ground water from pollution and degradation that arise from man's use of water and occupancy of land. When discharged to the land, the following are some of the more significant sources of pollution and degradation: (1) Industrial wastes, including brines, pickling acids, refinery wastes, packing plant wastes, etc.; (2) water-softener regeneration wastes; (3) refuse and rubbish in dumps; (4) leachate from cesspools; and (5) irrigation return water.

Salt balance in ground-water basins is another water-quality problem that is aggravated by man's use and reuse of water.

2971. Williams, E. G. INFLUENCES OF PARENT MATERIAL AND DRAINAGE CONDITIONS ON SOIL PHOSPHORUS RELATIONSHIPS. Agrochimica. 3(4): 279-309. Ref. Sept. 1959. 385 Ag84

Influences were discussed of parent material and drainage conditions on soil phosphorous relationships in Scotland.

2972. Williams, S. G. DRAINAGE COMES FIRST IN IMPROVING MURRAY SWAMPS PASTURES. I. So. Austral. Dept. Agr. J. 65(5): 172-179. (Cont.) Dec. 1961. 23 So84

A report was given on the need, use, and maintenance of drainage for improving swamp pastures in South Australia.

2973. Williamson, R. E. ROOT AERATION AND FESCUE GROWTH. (Abs.) Plant Physiology 38, pp. XLIX. 1963. 450 P692

An abstract was given on research on the response of fescue to varying conditions of drainage and root aeration.

2974. Williamson, R. E. THE EFFECT OF ROOT AERATION ON PLANT GROWTH. Soil Sci. Soc. Amer. Proc. 28: 86-90. 1964. 56.9 So3

A report was given on measuring of oxygen diffusion rates in soil in lysimeters. Water tables were maintained by subsurface watering at 6- to 30-inch depths below the soil surface.

2975. Williamson, R. E., and Willey, C. R. EFFECT OF DEPTH OF WATER TABLE ON YIELD OF TALL FESCUE. Agron. J. 56(6): 585-588. Nov./Dec. 1964. 4 Am34P

Without surface watering, tall fescue yielded approximately the same with water table depths of 9 and 17 inches. With 1 inch of surface water per week, the maximum yield was obtained with a 16-inch water table depth. The reduction in yield with the 8-inch water table depth was attributed to leaching nitrogen from the root zone. Aeration measurements in the root zone offer a means of extrapolating desired water table depths to other soil types.

2976. Yadav, J. S. P. EFFECT OF DRAINAGE ON MOISTURE RELATIONS OF A HEAVY CLAY SOIL. Indian Forester. 87(3): 170-179. Ref. Mar. 1961. 99.8 In2

A report was given on the effect of drainage on moisture relations on a heavy clay soil in England determined by tensiometers, nylon resistance units, and tension apparatus.

2977. Yadav, J. S. P. TRACE ELEMENT CONTENT OF A HEAVY CLAY SOIL FROM ENGLAND UNDER FREE AND POOR DRAINAGE. Indian Forester. 90(6): 360-365. June 1964. 99.8 In2

A report was given on the trace element content of a heavy clay soil from England under free and poor drainage. Drainage had very little effect on the total content but poor drainage caused an appreciable increase in the amount of the "available" fraction for most minor elements, especially for Cu, Co, Ni, and Pb.

2978. Yamaguchi, H., and Namiki, K. STUDIES ON TECHNICAL IMPROVEMENT OF PADDY CULTURE ON ILL-DRAINED FIELDS. II. ON THE EFFECTS OF BAIDO IN ILL-DRAINED FIELDS. (Ja) Crop Sci. Soc. Japan Proc. 24: 268-270. July 1956. 22.5 C88
English summary.

The effects of the Braido practice (a method of cultivation to earth up growing rice plant hills) were studied on a poorly drained paddy field in Japan.
The authors concluded that the Braido practice was a useful technique especially for poorly drained fields, when it was worked at the correct time.

2979. Yamaguchi, H., Shiratori, K., and Koizumi, A. RESEARCHS ON THE TECHNICAL IMPROVEMENT OF RICE CULTURE ON ILL-DRAINED FIELDS. (Ja) Crop Sci. Soc. Japan Proc. 26(1): 3-7. Sept. 1957. 22.5 C88
English summary.

The results of a research study of growing rice on poorly drained fields in Japan were given. "Akagore" disease was found to be caused by: (1) A poor natural supply of potassium; (2) high humus content of the soil; (3) excess of ammonium nitrogen; (4) deficiency in oxygen; (5) reduction of Eh values; and (6) harmful substances such as organic acids, ferrous compounds, or hydrogen sulphide in the soil. Thirteen different types of "Akagore" paddy fields were classified according to the above factors.

2980. Yefimov, V. N. FORMS OF ACCUMULATION AND MIGRATION OF SUBSTANCES IN BOG SOILS. Prochvovedeniye. 6: 67-76. June 1961. 57.8 P34
English translation—Soviet Soil Sci. 6: 643-650. June 1961. 57.8 P34Ae

During the transformation of peat-producing plants into peat considerable changes occur in ash content and composition. The forms of accumulation and migration of substances of different types of bog soils were discussed.

2981. Yermanos, D. M., Francois, L. E., and Bernstein, L. SOIL SALINITY EFFECTS ON CHEMICAL COMPOSITION OF THE OIL AND THE OIL CONTENT OF SAFFLOWER SEED. Agron. J. 56(1): 35-37. Jan./Feb. 1964. 4 Am34P

Soil salinity depressed oil content, seed weight, protein content, and the seed contribution to total yield of tertiary heads of safflower seed. It increased percent hull content of the seed but did not affect the fatty acid composition of the oil.

2982. Yli-Vakkuri, P. STUDIES ON BURNING AS SILVICULTURAL MEASURE ON DRAINED PEATY SOILS. (Fi) Acta Forest Fenn. 67(4): 33 pp. Ref. 1959. 99.9 F492
German summary.

2983. Yoneda, S. STUDIES ON POLDER SOILS IN JAPAN. XVII. NATURE OF SALTED SOIL FORMED BY FLOODING OF SEA WATER AT THE TYPHOON "ISEWAN". (Ja) Okayama U. Facul. Agr. Sci. Rpt. 18: 51-60. Sept. 1961. 107.6 Ok12
English summary.

A report was given on the chemical and physical changes in the soil in a polder in Japan after the area was flooded with salt water from the typhoon "Isewan".

2984. Yoneda, S., Shimose, N., Kawada, N., and Kochi, T. RECLAMATION AND FERTILIZER PRACTICES OF POLDER SOILS. (Ja) Okayama Agr. Expt. Sta. Spec. B. 51: 1-20. Ref. Feb. 1955. 107.6 Ok1R
English summary.

The pH and magnesium content of some halogentic polder soils in Japan were given. Asade rice plants were grown in a newly formed polder field and fertilized with various types of phosphorous fertilizer. It was determined that rice plants cultured in a newly formed polder field did not require much additional phosphate fertilizer.

2985. Yoshino, M., Nakarara, M., Jo, K., and Koga, H. ON "B HORIZON-GLEI" FOUND IN THE PADDY FIELD WITH POOR DRAINAGE AT THE BACKGROUND OF THE ARIAKE POLDER. (Ja) Kyushu Agr. Res. 17: 118-119. May 1956. 107.6 K996

2986. Yoshino, M., Nakahara, M., Jo, K., and Koga, H. ON "B HORIZON-GLEI" FOUND IN THE PADDY FIELD WITH POOR DRAINAGE AT THE BACKGROUND OF THE ARIAKE POLDER. (Ja) Sag. Agr. Expt. Sta. B. 3: 21-22. Mar. 1962. 107.6 Sa1K

2987. Zaitsev, B. D. CERTAIN PROBLEMS OF DRAINAGE AND UTILIZATION OF SWAMPY AND PEAT SOILS UNDER FORESTRY CONDITIONS. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 31: 127-141. Ref. 1955. 99.9 Ak1

2988. Zamouril, J. INCREASING THE YIELDS OF WET MEADOWS IN MOUNTAINOUS AND SUBMOUNTAINOUS REGIONS THROUGH DRAINAGE. (Cz) Picninarstvi a Krmivova Zakl. 2(10): 230-231. Oct. 1958. 60.8 P58

2989. Zentmyer, G. A., Paulus, A. O., and Burns, R. M. AVOCADO ROOT ROT. Calif. Agr. Expt. Sta. C. 511, 18 pp. 1962. 100 C12S

An avocado planting will develop root rot if the soil contains the fungus Phytophthora cinnamomi, and if there are periods of excess soil moisture. The fungus commonly becomes active as a result of poor internal soil drainage, but may also become troublesome on the better-drained soils because of breaks in water lines, overirrigation, or excessive rainfall. Drainage may be poor because of an impervious layer under the surface soil or because the entire soil profile contains considerable clay, or because strata of different textures interfere with internal soil drainage.

2990. Zhdannikova, E. N., and Popova, Z. P. EFFECT OF RECLAMATION BY DRAINAGE ON THE MICROFLORA OF FOREST SOILS. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 50: 163-167. 1961. 99.9 Ak1

2991. Zhdanova, E. I. MOISTURE AND TEMPERATURE REGIME OF PEAT SOILS DURING FALL, WINTER, AND SPRING PERIOD. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 135-144. 1962. 20 M857

2992. Ziza, A., and Nikonov, M. N. AGRICULTURAL UTILIZATION OF PEAT BOGS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury, 1955. 181 pp. 1955. 56.33 Z6S

2993. Zubets, V. M., ed. FIFTY YEARS OF THE MINSK BOG STATION. (Rus) Minsk, Gosudarstvennoe Izdatel'stvo Sel'skokhozyaistvennoi Literatury BSSR, 1963. 206 pp. 1963. 54.9 M665

SEE ALSO--369, 380, 384, 393, 453-455, 464, 495, 497, 511, 514, 520, 530, 532, 542, 550, 559, 604, 633, 634, 646, 655, 674, 693, 715, 716, 724, 731, 736, 759, 762, 812, 826, 868, 891, 902, 918, 939, 952-956, 958, 992, 997, 1001-1003, 1025, 1028, 1038, 1040, 1080, 1081, 1119, 1146, 1160, 1175, 1176, 1181, 1185, 1191, 1199, 1201, 1212, 1252, 1351, 1363, 1371, 1373, 1379, 1430, 1449, 1475, 1573, 1597, 1609, 1611, 1619, 1620, 1627, 1677, 1684, 1689, 1696, 1703, 1705, 1710, 1717, 1731, 1738, 1755, 1763, 1766, 1770, 1779, 1791, 1797, 1830, 1835, 1846, 1850, 1857-1860, 1868, 1882, 1893, 1895, 1900, 1904, 1907, 1942, 1952, 1957, 1960, 1980, 1981, 1985, 1991, 1993, 1997, 1998, 2001, 2016, 2039, 2053, 2055, 2066, 2087, 2104, 2107, 2119, 2135-2138, 2142, 2143, 2172, 2176, 2201, 2209, 2213, 2215, 2216, 2219-2221, 2227, 2239, 2246, 2252, 2259, 2268, 2292, 2344, 2365, 2367, 2368, 2370, 2377, 2389, 2995, 3046, 3059, 3071, 3095, 3100, 3106, 3110, 3131, 3175, 3189, 3207, 3208, 3229, 3248, 3267, 3276, 3287, 3294, 3309, 3320, 3321, 3323, 3330, 3334, 3360, 3405, 3415, 3427, 3434, 3435, 3439, 3482, 3483, 3501, 3516, 3586, 3587, 3592, 3593, 3598, 3600, 3604, 3635, 3636, 3649, 3675-3677, 3681, 3693, 3708, 3709-3711, 3716, 3720, 3722, 3731, 3739, 3755, 3758, 3760, 3770, 3771, 3778, 3791, 3806, 3817, 3828, 3864, 3871, 3875, 3885, 3886, 3929, 3932, 3950-3952, 3957, 3970, 3995, 3999, 4002, 4003, 4012, 4025, 4030, 4034, 4038, 4045, 4055, 4061, 4070, 4071, 4073, 4083, 4106, 4139, 4358, 4399, 4557, 4567, 4607, 4710, 4826, 4847, 4850-4854, 4857, 4861, 4862, 4871, 4872, 4875, 4888, 4896, 4901, 4909, 4912, 4920, 4922, 4937, 4948, 4969, 4971, 4984, 4987, 4990-4993, 4998, 5005, 5010, 5020, 5023, 5045, 5047, 5054, 5059, 5060.

DRAINAGE PRACTICES - RESEARCH AND APPLICATION

Surface Drainage

2994. Agnew, L. B. NEW WATER MANAGEMENT SYSTEM HELPS LOUISIANA SUGARCANE GROWERS. Soil Conserv. 26(12): 278-279. July 1961. 1.6 So3S

A report was given on the use of land grading and V-type ditches for water management in Louisiana sugarcane fields.

2995. Ai, Y. H., and Huang, H. C. A STUDY ON SEVERAL ECONOMIC QUESTIONS CONCERNING LAND LEVELING. U.S. Joint P. Res. Serv. Transl. Chingchi Yen-chiu (Econ. Res.) 3: 90-102. June 4, 1964. 173 J663Trf
Translation from Ching-chin Yen-chiu, 3: 49-55. Mar. 17, 1964.

A report was given on an economical study of land leveling in China.

2996. Alcorn, F. B. CONSERVATION BERRY FARMING-FORMULA FOR FAMILY'S SUCCESS. Soil Conserv. 29(2): 39-40. 1963. 1.6 So3S

A report was given on the need and use of terraces and other soil conservation practices for small fruit and vegetable production in Illinois.

2997. Alexandrescu, I., Protopopescu, V., and Popa, C. PUTTING TO BETTER USE SKELETAL [LITHOSOL] SOILS ON SHARP SLOPES IN DOBRUJA REGION BY TERRACING AND GRAPE PLANTING. (Rum) Bucharest Inst. de Cercet. Horti-Vitic. Lucrari Sti. 1959-60: 41-52. 1961. 86 R862
French summary.

2998. Anicic, M. THE SOIL CONSERVATION PRACTICE IN THE ORCHARD'S LAY OUT. (Se) Agron. Glasnik. 12(9/10): 796-805. 1962. 21.5 Ag84
English summary.

A report was given on the terracing of orchard lands in Yugoslavia.

2999. Aparicio Santos, J. TERRACES TO CONSERVE SOIL AND MOISTURE. (Sp) Spain Min. de Agr. P. de Capacitacion Agr. Hojas Divulg. 14-56 H, 16 pp. July 1956. 15 H68

3000. Arghiriade, C., Abagiu, P., and Ceuca, G. SURFACE DRAINAGE OF FOREST BASINS. (Fr) Cong. Internatl. de Sylvicult. Deleg. de la Repub. Pop. Roumaine. Trav. 5: 71-73. 1960. 99.9 C76912T

3001. Atkins, M. D. PERMANENT WATERWAYS. What's New Crops and Soils. 10(2): 14-15. Nov. 1957. 6 W55

A report was given on the seeding of native grasses and tame grasses in permanent waterways in Kansas. The native grasses can be seeded mixed with the tame grasses at the time of planting or overseeded at a later period.

3002. Atkins, M. D., and Coyle, J. J. GRASS WATERWAYS IN SOIL CONSERVATION. U.S. Dept. Agr. L. 477, 8 pp. 1960. 1 Ag84L

To establish and maintain an effective grass waterway: (1) Locate waterway in a natural drainageway if possible; (2) clear trees or brush from the site and shape to proper size; (3) prepare a good, firm seedbed and use a crop residue or a mulch to protect the waterway and grass seedlings during establishment; (4) select a grass or simple grass mixture that best fits the conditions of the waterway; (5) use good quality seed; (6) use grass origins and strains known to be adapted; (7) plant at the best date for the particular grass; (8) use planting equipment and methods that give uniform distribution and proper placement of seed; (9) fertilize according to the needs of the grass and your soil as shown by soil tests; (10) overseed or repair bare spots with sod chunks or mulch as necessary; (11) avoid using the waterway as a road or damaging the sod with tillage implements; (12) use the waterway moderately for grazing or hay; (13) mow when grass can make good regrowth and restore food reserves in the roots; (14) inspect frequently, especially after each heavy rain and repair any damages at once; and (15) keep livestock and equipment out of the waterway when it is wet and soft unless it is naturally a seepy area.

3003. Bakker, A. C. PREPARE ORCHARD DRAINAGE EARLY IN AUTUMN. Victorian Hort. Digest. 8(4): 22. Summer 1964/65. 80 V662

A report was given on the need of preparing orchard drainage early in the autumn in Australia.

3004. Balsotti, L. TECHNICAL AND ECONOMIC CONSIDERATIONS ON THE PREPARATION OF EARTH BY TERRACING IN REFORESTATION PROGRAMS. (It) Monti e Boschi. 10(5): 211-216. May 1959. 16 M76
English summary.

A report was given on the advantages and the use of plantings in Italy over the use of regular planting hole method.

3005. Baquero, G. PREPARATION OF LAND FOR SPRINKLER IRRIGATION. (Fr) Cong. Irrig. and Drain. Trans. 4(4): 12.193-12.208. 1960. 55.9 C7652
English summary.

A report was given on the value of terraces for sprinkler irrigated land in Spain.

3006. Bartleet, J. R. GRADED BANKS FOR DISPOSAL OF SURPLUS RUN-OFF WATER. New Zeal. J. Agr. 100(4): 387, 389, 391. Apr. 15, 1960. 23 N48J

A report was given on the use and construction of graded banks (terraces) for disposal of surplus runoff water in New Zealand. The use and construction of diversion banks (diversion terraces) were also discussed.

3007. Bartleet, J. R., and Drost, H. CONTOUR BANKING IN NORTHLAND: INVESTIGATION PROBLEMS. Symp. Hydrol. and Land Mangt. Proc. 1962: 148-150. 1963. 292.9 N484

A report was given on the use of contour banks (terraces) in Northern New Zealand.

3008. Beadley, R. P., and Meyer, L. D. NEW TERRACE CONSTRUCTION TECHNIQUE. Agr. Engin. 38: 32-36. 1957. 58.8 Ag83

Terraces that were easier to farm and that lower farm operating costs by reducing the point-row area on cropland and other shortcomings of conventional terracing were made possible by a new technique developed known as "parallelized terracing." The method used required more time than a conventional system and the construction costs were somewhat greater due to the lateral movement of soil. These terrace systems were easier to farm, and the cost of the farming operations was less. Over a period of time, the greater initial cost was offset by the reduced cost of farming with the system.

3009. Beare, J. A. CONTOUR PLANTING PROTECTS ORCHARDS AND VINEYARDS. So. Australia Dept. Agr. J. 59: 448-451, 455. June 1956. 23 So84

A report was given on the use of contour planting to form a series of contour banks (terraces) in orchards and vineyards to improve surface drainage and reduce erosion in South Australia. A slope of 1 to 1-1/2 percent was recommended for the rainy areas to improve drainage and prevent waterlogging. Furrow irrigation and sprinkler irrigation are both used in the contour planted orchards and vineyards.

3010. Beasley, R. P. MAKING TERRACES MORE FARMABLE. World Farming. 2(7): 4-6, 32-33. July 1960. 30.08 W89

An illustrated report was given on the remodeling of uniform grade terraces to the parallel type terraces in Missouri.

3011. Beasley, R. P. A NEW METHOD OF TERRACING: THE VARIABLE-GRADE, VARIABLE-CUT TERRACE. Mo. Agr. Expt. Sta. B. 699 (Rev.) 22 pp. 1963. 100 M693

The extent that a terrace system can be improved by the variable grade, variable cut method of terracing will depend upon: (1) The irregularity of the topography; (2) the type of soil; (3) the type of equipment to be used in building the terraces; and (4) the amount of money to be spent on construction.

New techniques in the design, layout, and construction of variable-grade, variable-cut terraces were explained which will result in terraces with less curvature, more uniform spacing, and fewer point rows. A thorough knowledge of the principles and techniques involved is needed by the technician to plan and lay out the best possible terrace system.

3012. Beasley, R. P. TERRACES THAT CAN BE CULTIVATED. (Sp) Agr. de las Amer. 13(4): 32-34, 36. (Cont.) Apr. 1964. 58.8 Ag832

3013. Beasley, R. P. A NEW METHOD OF TERRACING. Hoard's Dairyman. 109(13): 736-737. July 10, 1964. 44.8 H65

An illustrated report was given on the use and construction of parallel terraces.

3014. Beasley, R. P., and Meyer, L. D. NEW TERRACE CONSTRUCTION TECHNIQUE. Agr. Engin. 38: 32-36. Jan. 1957. 58.8 Ag83

A report was given on the use of parallel terraces to reduce point-row areas of cropland and other shortcomings of conventional terraces.

3015. Beck, V. S. HELP FOR TEXAS WATERWAYS. Land Impr. 4(1): 9-11. Jan. 1957. 282.8 L224

A report was given on the value of Bermudagrass sodded waterways in Texas. The use of drop inlets was stressed to stabilize the mouth of the waterways, where the waterways empty into a roadside ditches.

3016. Beirne, K. G. GRADED BANKS IN THE CAMDEN SUB-DISTRICT. N. S. Wales, Soil Conserv. Serv. J. 14(3): 177-183. July 1958. 56.9 N472

A report on the use of terraces and diversions for pasture and cultivated land was given for New South Wales.

3017. Bellard, C. F. RICELAND SMOOTHING—UNDER WATER. Soil Conserv. 28(7): 158-159. 1963. 1.6 So3S

A report was given on land leveling of riceland under water.

3018. Bellis, R. E. SISAL AND THE SOIL IN KENYA. Kenya Sisal Bd. B. 33: 19-22. July 1960. 73.29 K42

A report was given on drainage and soil conservation practice used in Kenya for sisal production.

3019. Beloborodov, V. N. TERRACING MOUNTAIN SLOPES OVER VINEYARDS. (Rus) Vinodel. i Vinograd. SSSR 16(3): 25-30. 1956. 95.8 V77

3020. Bertoni, J. PARALLEL TERRACING, NEW CONSERVATION TECHNIQUE. (Por) Anu. Bras. de Econ. Florestal. 13(13): 121-123. 1961. 99.83 An8

3021. Beshore, G. WHIP POTHOLES WITH SURFACE DRAINAGE. Capper's Farmer. 67(6): 46, 50. June 1956. 6 M693

A report was given on the use of surface drainage to drain small potholes. The surface drainage was designed to supplement tile not replace it.

3022. Biggar, W. J. SCIENTIFIC APPROACH TO CONTOUR PLANTING ON MOUTERE HILLS. Orchardist New Zeal. 28(11): 2-3, 5, 7. Dec. 1955. 80 Or19

A report was given on the use of contour banks (terraces) for orchards in New Zealand.

3023. Bogdanovich, V. I. SIMPLE METHOD OF CONTROL FOR LEVELLING. (Rus) Gidrotekh. i Melior. 1960(9): 19-22. Sept. 1960. 290.8 G362

3024. Borden, J. W. LET'S TAKE A NEW LOOK AT LAND SMOOTHING! Through Leaves. 44(4): 45-52. Sept./Oct. 1956. 66.8 T41

The use of land smoothing for the drainage of irrigated lands was given for Ohio and Michigan.

Excellent results were obtained in northeastern Ohio with land smoothers for the following conditions: (1) For eliminating small pockets of about 10 feet in diameter and 1 to 12 inches deep in both tiled and untiled land; (2) on large pasture areas where bedding is practiced; (3) for spreading spoil created after building shallow sod waterways and ditches; (4) on new land that has been cleared or plowed for the first time in several years; and (5) on slopes up to 4 percent to insure surface drainage on poorly drained soils.

3025. Borden, J. W. LAND FORMING FOR IRRIGATION, DRAINAGE, EROSION CONTROL AND EFFICIENT FARM MANAGEMENT. Internatl. Cong. Agr. Engin. Trans. 5(1): 436-446. 1958, pub. 1960. 290.9 C7652

A report was given on the use of land farming in the United States for irrigation, drainage, erosion control, and efficient farm management.

3026. Breil, P. CONTRIBUTION TO THE STUDY OF THE COST OF DRAINAGE AND PUMPING. (Fr) Cong. Irrig. and Drain. Trans. 5(6): C.9.135-C.9.146. 1963. 55.9 C7652
English summary.

A report was given on the cost of lowering high water tables by surface drains, buried drains, and by pumping in Morocco.

3027. Brill, G. D., Slater, C. S., and Broach, R. V. D. CONSERVATION METHODS FOR SOILS OF THE NORTHERN COASTAL PLAIN. U.S. Dept. Agr., Agr. Inform. B. 271, 12 pp. 1963. 1 Ag84Ab

A report was given on conservation methods for soils of the Northern Great Plains—including terraces, diversion terraces, grass waterways, and subsurface drainage.

3028. Broach, R. V. D., Slater, C. S., Augustine, M. T., and Evaul, E. E. JUTE FOR WATERWAYS. J. Soil and Water Conserv. 14(3): 117-119. May 1959. 56.8 J822

A report was given on the use of jute thatching to control erosion for seeding establishment in waterways. The author concluded that: (1) The jute thatching was easier to lay and hold in place than mulch; (2) it had the tensile strength and weight to resist severe conditions of water flow and erosion; and (3) the cost, for critical areas, was not prohibitive.

3029. Buie, T. S. "WALKING" WATER DOWNHILL. Amer. Fruit Grower. 82(5): 44. 1962. 80 G85

Progressive South Carolina orchardists are planting their new peach and apple orchards on the contour. The precise, straight-row arrangement—long considered essential for the efficient use of spray and cultivating equipment—is giving way to gently curving rows fitted against the side of the sloping hill.

Each terrace-row discharges its surplus water into grassed drains where the soil particles are strained out. The clear water finds its way slowly to the pond at the foot of the hill. From there it may be pumped back to the trees when irrigation is necessary.

3030. Burcalow, F. V., Johannes, R. F., and Peterson, A. E. LAND FORMING: THE WOJTA SYSTEM OF SURFACE DRAINAGE. Wis. Agr. Col. Ext. C. 587, 8 pp. July 1960. 275.29 W75C

The Wojta system of land forming surface drainage in Wisconsin was described and illustrated.

3031. Burnett, G. I. S. WATER AND FARMING. I. SURFACE DRAINAGE ON SLOPES. New Zeal. Meat Prod. 7(11): 43. Aug. 1, 1963. 50.8 N48

A report was given on surface drainage needs on sloping land in New Zealand by contour banks (terraces).

3032. Burnett, G. I. S. WATER AND FARMING. II. FURROWS AND OPEN DRAINS. New Zeal. Meat Prod. 7(12): 51, 53. Sept. 2, 1963. 50.8 N48

A report was given on surface drainage needs on flat lands in New Zealand.

3033. Calzecchi-Onesti, A. CRITERIA TO BE FOLLOWED FOR TERRACING. XII. (It) Gior. di Agr. 65: 315-316. Sept. 18, 1955. 16 It1G

3034. Calzecchi-Onesti, A. TERRACING. XIII. (It) Gior. di Agr. 65: 365-366. Oct. 23, 1955. 16 It1G

3035. Calzecchi-Onesti, A. HILL RECLAMATION IN THE UNITED STATES. (It) Gior. di Agr. 65: 421. Dec. 4, 1955. 16 It1G

3036. Calzecchi-Onesti, A. THE CORE OF THE DRAINAGE PROBLEM. (It) Gior. di Agr. 65: 439-440. Dec. 18, 1955. 16 It1G

3037. Candel Fabregat, L., and Aguilo Bonnin, J. CIRCULATION OF WATER IN CONTOUR TERRACES WITH OPEN ENDS. (Sp) Spain Serv. Conserv. Suelos. Bol. Tec. 2, 32 pp. Aug. 1963. 56.9 Sp1B English summary.

A report was given on the use of open end contour terraces in Spain.

3038. Carlo, G. D. ECONOMIC COMPARISON OF THE VARIOUS TYPES OF TERRACING. (Sp) Florence 1st. Sper. per lo Studio e la Difesa del Suolo. Ann. 2(6): 1-19. 1955, pub. 1956. 56.9 F66

3039. Carlton, E. P. TERRACES STOP "WET FEET" IN OHIOAN'S PEACH ORCHARD. Soil Conserv. 29(2): 46. 1963. 1.6 So3S

A report was given on the use of terraces for surface drainage of peach orchards in Ohio.

3040. Carreker, J. R., and Thornton, J. F. LAND FORMING FOR DRAINAGE OF COASTAL SOILS. (Abs.) Assoc. Southern Agr. Workers Proc. 54: 47. 1957. 4 C82

A report was given on land forming for the drainage of coastal soils.

3041. Caterpillar Tractor Company. LAND FORMING IMPROVES FIELD DRAINAGE. Sugar J. 21(10): 19-21. Mar. 1959. 65.8 Su391

A report was given on the use of land forming to improve field drainage and prevent erosion in sugarcane fields. Average costs of land forming were $40 to $100 per acre.

3042. Chang, T. T. THE BENCH TERRACE FOR SUGARCANE IN TAIWAN. Taiwan Sugar. 8(9): 13-17. Sept. 1961. 65.8 T133

A report was given for the construction and use of bench terrace for sugarcane production on 12 to 50 percent slopes in Taiwan.

3043. Chichanov, K. TERRACING ON SLOPES IN VINEYARDS IN MOLDAVIAN SSR. (Bu) Mashinizirano Zemedel. 8(11): 23-28. Nov. 1957. 58.8 M374

3044. Christiansen-Weniger, F. TERRACE AGRICULTURE IN YEMEN. (Ge) Internatl. Union Conserv. Nat. and Nat. Resources. Tech. Mtg. 7(2): 347-349. 1958, pub. 1960. 279.9 In84Pt

3045. Claesson, S. DO NOT FORGET SURFACE LEVELING—BUT IT NEEDS GOOD EQUIPMENT. (Sw) Jord och Skog. 13(7): 348-349. 1961. 58.8 M373

3046. Claesson, S. LEVEL FOR BETTER HARVEST. (Sw) Sodermanlands Lans Hushsallsk. Arsb. 1962: 46-50. 1962. 11 So1A

3047. Conlon, T. J., Douglas, R. J., and Whitman, W. C. GRASSED WATERWAYS STOP GULLIES, ALSO PRODUCE VALUABLE HAY CROP. N. Dak. Agr. Expt. Sta. Bimon, B. 18: 124. Mar./Apr. 1956. 100 N813B

A report was given on the use of grassed waterways in North Dakota to stop gullies and produce hay crops.

3048. Constantinescu, G. LAND UTILIZATION OF SLOPES BY PLANTING WITH VINEYARDS. (Rum) Fradina Via si Livada. 9(6): 6-16. June 1960. 80 G75
English summary.

A report was given on the use and construction of bench terraces in Rumania for growing vineyards.

3049. Constantinesku, G. RECLAMATION OF HILLS FOR COMMERCIAL VINEYARDS. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 1961(3): 75-79. 20 M57

3050. Coradini, M. "LEVELLING" IN THE DRAINAGE OF IRRIGATED LANDS. (It) Agr. Sarda. 33: 44-47. Feb. 1956. 16 Ag825

3051. Corley, T. E. LAND FORMING IN ROLLING AREAS. Cotton Mech. Annu. Conf. Proc. 11: 21. 1957. 281.3729 B41

A report was given on the need and use of land forming by terraces for surface drainage in rolling areas in Alabama.

3052. Corley, T. E., Helms, J. O., Kummer, F. A., and Stokes, C. M. PREPARING LAND FOR MECHANIZATION IN THE SOUTHEAST. Agr. Engin. 38(10): 730-733. Oct. 1957. 58.8 Ag83

A report was given on the use of parallel terraces to prepare land for mechanization in the southeast area of the United States.

3053. Coyle, J. J. A DICTIONARY OF TERRACES. Land Impr. 6(10): 6-7. 1959. 282.8 L224

Standard terraces, conventional terraces, parallel terraces, ridge terraces, channel terraces, level terraces, graded terraces, broadbase terraces, Nichols terraces, Mangum terraces, basin terraces, and diversion terraces are all terms you hear and read about.

Each of these names describes some feature of a type of terrace designed to meet a problem common in some part of the country. Often different terms spring up in different localities for the same feature of terrace design.

To help reduce the confusion, this paper relates these names to a few basic terms that describe important features of terraces. Alternate or local names are given for each type.

3054. Coyle, J. J. A NEW LOOK FOR TERRACED FIELDS. Soil Conserv. 26(12): 268-270. July 1961. 1.6 So3S

A report was given on the increased use of parallel terracing in the United States.

3055. Crescini, F. "LOMBARDY" SYSTEM OF SURFACE DRAINAGE OF SOIL. (It) B. dell'Agr. 92(9): 1. Feb. 28, 1958. 16 B87

3056. Crescini, F. LOMBARD DRAINAGE OF SOIL SURFACE. (It) Italia Agr. 95(8): 463-467. Aug. 1958. 16 Itl

3057. Crescini, F. "LOMBARD" LAND DRAINAGE. (It) Genio Rur. 21(10): 952-956. Oct. 1958. 281.8 R522

3058. Dastane, N. G., Joshi, M. S., and Singlachar, M. A. HOW TO PREVENT WATER LOGGING. Indian Farming. 13(3): 7-8. June 1963. 22 In283

A report was given on the use of land forming (by ridges) and shallow rooted crops for waterlogged areas in India.

3059. Dean, T. M. SAFE WATER DISPOSAL ON OLD BELT TOBACCO FIELDS. J. Soil and Water Conserv. 17: 80-81. 1962. 56.8 J222

Safe disposal of excess runoff from tobacco fields in the bright tobacco "Old Belt" in southern Virginia presents some difficult technical problems.

A complete runoff control system cannot be expected to prevent all soil, water, and plant food losses from intensely cultivated tobacco fields, but with good grassed waterways in the right places, proper terracing, and correct row layout, these losses can be reduced to tolerable amounts.

3060. De Silva, C. A. SOIL CONSERVATION, DRAINAGE AND HOLING. Rubber Res. Inst. Ceylon. Q.C. 34(1/2): 1-7. June 1958. 78.9 C33Q

The results of various soil conservation methods for the production of rubber in Ceylon were given. The following practices were discussed: Main drains; lateral storm drains; lateral drains; contour stone terraces; low-lying land drainage; and hole drainage.

3061. Despois, J. NOTE ON THE TERRACING IN SARDAIGNE. (Fr) Rev. de Geog. de Lyon. 36(1): 7-10. 1961. 473 Et8

3062. Dizengof, G. I., and Dizengof, L. F. RECLAMATION OF MOUNTAIN SLOPES OF BLACK SEA COAST AREA OF KRASNODAR TERRITORY. (Rus) Subtrop. Kult. 1960(4): 87-92. 1960. 68.19 M28 English summary.

A report was given on the use of terraces on mountain slopes in the Krasnodar Territory for fruit production.

3063. Donyshkin, V. I. TERRACING SLOPES. (Rus) Sadovodstvo. 11: 18-19. 1963. 80 Sa13

3064. Edminster, T. W. LAND LEVELING MOVES EAST. Soil Conserv. 21: 151-153. Feb. 1956. 1.6 So3S

A report was given on the use of land leveling in the Eastern United States.

3065. Edminster, T. W. LAND PREPARATION FOR EFFICIENT COTTON PRODUCTION. Cotton Ginaand Oil Mill Press. pp. 35. Oct. 19, 1957. 304.8 C82

A report was given on a symposium on the use of land preparation for efficient cotton production.

3066. Edminster, T. W. LAND PREPARATION FOR EFFICIENT COTTON PRODUCTION. Cotton Mech. Annu. Conf. Proc. 11: 18. 1957. 281.3729 B41

A report was given on a symposium on the use of land preparation for efficient cotton production.

3067. Edminster, T. W. LAND FORMING AND SMOOTHING FOR EFFICIENT PRODUCTION. Agr. Engin. 40: 84-86. 1959. 56.8 So3

Full production efficiency cannot be achieved if we fail to consider the problems of putting the land itself into shape for maximum efficient and effective operation.

Essentially, this is the process of "land conditioning." It is a multiple approach to many problems. It is "land forming" for improved drainage and irrigation; it is "land smoothing" for high-speed, precision mechanization. It is fitting the field for the application of terraces, diversions, strip cropping, and contour row layouts, and it is a process of eliminating machinery hazards. "Land conditioning" is, then, the application of practices that make good farming, good conservation, and effective and efficient production work together under a modern program of mechanical agriculture.

3068. Edminster, T. W. CONTROL OF SURFACE WATER BY LAND FORMING. Internatl. Cong. Soil Sci. Trans. 7(1): 411-417. Ref. 1960. 56.09 In847T

Land forming rearranges the earth's surface permitting improved water management. Through adjustment of the micro-relief of a field, positive surface drainage can be achieved. By grading to selected slopes, uniform irrigation may be applied with a minimum of ponding or erosion. Smooth uniform fields facilitate high speed mechanization of farming operations.

Land forming, made possible by the rapid advancement in heavy earthmoving equipment, can tailor a field for optimum water management.

3069. Edminster, T. W., and Reeve, R. C. DRAIANAGE PROBLEMS AND METHODS. U.S. Dept. Agr., Agr. Ybk. 1957: 378-385. 1957. 1 Ag84Y

A discussion was given of drainage problems in the United States. Recommended methods for surface and subsurface drainage to solve these problems were described.

Good drainage practices must be accomplished by sound irrigation and soil-management practices if maximum benefits are to be obtained.

3070. Ewing, E. C. A PLANTER'S VIEW ON DRAINAGE. (Abs.) Assoc. Southern Agr. Workers Proc. 56: 47. 1959. 4 C82

A report was given on land forming for drainage and irrigation.

3071. Fasken, G. B. LAND DRAINAGE IN ILLINOIS. Land Impr. 5(7): 12-15. maps. July 1958. 282.8 L224

A report was given on land drainage needs and accomplishment in Illinois. A history of drainage practices was given. The use of both surface and subsurface drainage was recommended.

3072. Faulkner, M. D., and Miears, R. J. LEVELING RICE LAND IN WATER. La. Agr. 5(4): 3, 16. 1962. 100 L939

Proper irrigation of rice depends upon how well the depth of the water can be controlled and how uniformly the irrigation water can be applied.

Leveling can be made easier and more effective by flooding the land and working the machinery in the water. Because of the plow sole pan found in most rice soils, equipment can be supported under flooded conditions. By using the water as a moving agent, greater amounts of soil can be moved in water than on dry land when the same equipment is used. By leveling in water, levees can be greatly reduced in number or eliminated in small fields.

3073. Fedotov, V. S. TERRACING IN THE SLOPES UNDER VINEYARDS. (Rus) Sadov. Vinograd. i Vinodel Moldavii. 12(6): 37-39. Nov./Dec. 1957. 80 Sa15

3074. Fedotov, V. S. STRENGTHENING AND PRODUCTIVE UTILIZATION OF THE SLOPES OF TERRACES. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1961(6): 29-30. June 1961. 80 Sa15

3075. Fedotov, V. S. PLANNED TERRACING OF SLOPES WHERE LANDSLIDES HAVE TAKEN PLACE. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1961(11): 38-41. Nov. 1961. 80 Sa15

3076. Fedotov, V. S. TERRACING OF SLOPES FOR FRUIT ORCHARDS AND VINEYARDS IN MOLDAVIA. (Rus) Kishinev, Shtiintsa, 174 pp. 1961. 56.7 F315

3077. Fehr, R. SURFACE DRAINAGE ON FOREST ROADS BY TRANSVERSE FURROWS. (Ge) Schweiz. Z. f. Forstw. 112(3): 234-236. Mar. 1961. 99.8 J82

3078. Filimonova, V. A. METHODS OF LEVELING OF LEVEED FIELDS IN THE VOLGA-AKHTUBA FLOOD PLAIN. (Rus) Gidrotekh. i Melior. 9: 14-18. Sept. 1963. 290.8 G362

3079. Fontenot, D. L. LAND LEVELING PROVES BOON TO OVER 6000 U.S. FARMERS. Rice J. 61(21): 6-7. Nov. 1958. 59.8 R36

Land leveling provides the following conservation practices: (1) Permits uniform distribution of irrigation water; (2) improves surface drainage; and (3) holds erosion damage to a maximum. Drainage; irrigation-water management; crop rotation; fertilization, et cetera, all need to be coordinated with land leveling for rice production. Each supplement the other in achieving a more complete and effective conservation program.

3080. Foreman, H. G. CONTOUR RIPPING ON THE NORTH COAST. N. S. Wales Soil Conserv. Ser. J. 13(1): 11-16. Jan. 1957. 56.9 N472

A report was given on the use of contour ripping of pasture land in New Zealand.

3081. French, E. W., Promersberger, W. J., and Hughes, H. F. LAND FORMING FOR IMPROVED SURFACE DRAINAGE. N. Dak. Farm Res. 21(8): 4-12. Nov./Dec. 1960. 100 N813B

A report was given on the use of land forming in North Dakota to improve surface drainage. The following methods of surface drainage were discussed: Random ditch system; parallel ditch system; and bedding system.

3082. French, E. W., Promersberger, W. J., and Hughes, H. F. CHANGING THE FACE OF THE LAND. Co-op Grain Q. 19(1): 49-55. Mar. 1961. 280. 28 C7898

A report was given on the use of land forming for surface drainage in North Dakota.

3083. Fulgham, F. E. LAND GRADING FOR DRAINAGE IN THE YAZOO-MISSISSIPPI DELTA. (Abs.) Assoc. Southern Agr. Workers Proc. 54: 51. 1957. 4 C82

The growing interest in land grading in the Yazoo-Mississippi Delta was attributed to the following four interrelated management practices: (1) Drainage; (2) irrigation; (3) conservation; and (4) mechanization.

3084. Gain, E. W. DRAINAGE YOU CAN SEE. Rur. New Yorker. 106: 122, 142. Feb. 18, 1956. 6 R88

A report was given on surface drainage and closed (tile) drainage for New York. The economics and results were stressed.

3085. Gain, E. W. NATURE AND SCOPE OF SURFACE DRAINAGE IN EASTERN UNITED STATES AND CANADA. Trans. ASAE 7(2): 167-169. map. 1964. 290.9 Am32T

A report was given on the need and use of surface drainage in Eastern United States and Canada. A map was given showing the general areas and probable frequency or occurrance of typical sites and soil types requiring surface drainage in 31 eastern states, eastern Texas, and the eastern providences of Canada.

3086. Gavrilov, G. P. PREPARATION OF THE SOIL FOR VINEYARDS ON SLOPES. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1962(2): 38-39. Feb. 1962. 80 Sa15

3087. Gavrilov, G. P. SOME PROBLEMS IN THE PLANTING OF VINEYARDS ON TERRACES. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 11(115): 41-42. Nov. 1962. 80 Sa15

3088. Ghumare, N. K. STUDIES IN THE BEHAVIOUR OF CONTOUR BUNDS. J. Soil and Water Conserv. India. 10(1/2): 44-64. Jan./Apr. 1962. 56.8 J824

A report was given of the behavior of contour bunds (terraces) in India.

3089. Guiliani, E. OLD AND NEW DIFFICULTIES IN SOIL SYSTEMIZING. (It) Agricoltura. 8(3): 44-47. Mar. 1959. 16 Ag8226

3090. Glathaar, J. O. WATERWAYS AND CHUTES IN CONTOUR CULTIVATION. Farming So. Africa. 39(7): 37, 39, 41, 43. Oct. 1963. 24 So842

A discussion was given on the use and contruction of grassed waterways, stabilized gullies, and chutes for contour cultivation with contour banks (terraces) in South Africa.

3091. Grazys, J. SURFACE DRAINAGE OF FIELDS. (Li) Socialist. Zemes Ukis. 10: 32-35. Oct. 1962. 20 So1

3092. Green, R. L. LAND FORMING FOR DRAINAGE ON COASTAL SOILS. (Abs.) Assoc. Southern Agr. Workers Proc. 54: 52. 1957. 4 C82

A report was given on an experimental land forming study for improving surface drainage on lower southeastern Coastal Plain soils. Surface drainage is a problem in the area because of the topography, the typical heavy clay subsoils, and the climate in the area.

3093. Greig, D. J. THE TREATMENT OF PLANT CANE RIDGES ON BLACK CLAY SOILS IN GHANA. World Crops. 14(12): 419-420. Dec. 1962. 281.8 W892

A report was given on the use of ridges to improve the surface drainage of sugar cane on black clay soils in Ghana which have very poor internal drainage.

3094. Guzman, L. E. THE TERRACES OF THE ANCIENT MOUNTAIN MAYAS, CHIAPAS, MEXICO. (Sp) Rev. Interamer. de Cien. Sociales. 1(3): 398-406. 1962. 280.8 R3224

3095. Hand, J., and Carter, R. VALUE OF LAND FORMING ON PRODUCTION AND HARVESTING PRACTICES. Cotton Gin and Oil Mill Press. 64(2): 25-26. Jan. 19, 1963. 304.8 C822

A report was given on the value of land forming for surface drainage on the production and harvesting practice for cotton crops in Mississippi.

3096. Hanks, B. C. IMPROVEMENTS MADE IN TERRACING. Tex. Livestock J. 23(6): 8. June 15, 1964. 49 T29

A report was given on the use of parallel terraces in Texas.

3097. Harris, W. S. A PROGRESS REPORT ON A SURFACE FIELD DITCH. Ark. Farm Res. 11(5): 3. Sept./Oct. 1962. 100 Ar42F

A report was given on the effect of a surface field ditches in Arkansas formed by constructing a levee to be used as a turn row on a precision graded field.

3098. Harris, W. S. LAND GRADING IN ARKANSAS. Cotton Gin and Oil Mill Press. 64(25): 9, 30-31. Dec. 7, 1963. 304.8 C822

A report was given on the advantages of land grading in Arkansas for surface drainage and irrigation.

3099. Harris, W. S. ROW-CROP DRAINAGE IN THE ARKANSAS DELTA. Trans. ASAE 7(1): 64-66. 1964. 290.9 Am32T

A report was given on the use and value of surface row crop drainage in Arkansas.

3100. Harris, W. S. ROW DRAINAGE OBSERVATIONS IN THE DELTA. Ark. Agr. Expt. Sta. Spec. Rpt. 13, 17 pp. map. Apr. 1964. 100 Ar42Sp

Observations of surface drainage were made on 185 fields in eastern Arkansas to define the requirements for drainage in the Delta area.

3101. Harris, W. S. ROW CROP DRAINAGE IN ARKANSAS. Cotton Digest. 37(17): 9-10. Dec. 26, 1964. 286.82 C822

A report was given on the use of land grading to improve surface drainage in Arkansas cotton fields.

3102. Harris, W. S., and Hay, R. C. GULLY CONTROL WITHOUT STRUCTURES. PART 1. Trans. ASAE 6(1): 37-39. 1963. 290.9 Am32T

Gully rehabilitation and control normally consists of the construction and maintenance of a grassed waterway. The installation of a structure as a terminating device is often considered to be the essential first step, the very key, to the reclamation of a large gully.

A method of design of vegetated outlet sections for use in terminating grassed waterways was presented. The design method was based on an analysis of causes contributing to the formation of gullies in a specific area. The method of analysis is applicable to any waterway termination problem but design criteria must meet local requirements.

3103. Harris, W. S., and Jacks, J. F. SURFACE FIELD DITCH STUDIES IN NORTHEASTERN ARKANSAS. Ark. Farm Res. 10(6): 11. Nov./Dec. 1961. 100 Ar42F

A report was given on the consturction and the use of field ditches for surface drainage in northeastern Arkansas.

3104. Hauser, V. L. CONSERVING RUNOFF WATER WITH THE ZINGG CONSERVATION BENCH TERRACE. Soil Conserv. 27(4): 90-91. Nov. 1961. 1.6 So3S

A report was given of the use of the Zingg Conservation bench terrace to conserve water.

3105. Hauser, V. L., and Cox, M. B. EVALUATION OF ZINGG CONSERVATION BENCH TERRACE. Agr. Engin. 43(8): 462-464, 467. Aug. 1962. 58.8 Ag83

An evaluation was made of the Zingg conservation bench terraces to impound runoff water and control erosion.

3106. Hauser, V. L., Van Doren, C. E., and Robins, J. S. A COMPARISON OF LEVEL AND GRADED TERRACES IN THE SOUTHERN HIGH PLAINS. Trans. ASAE 5(1): 75-77. Ref. 1962. 290.9 Am32T

A comparison was made of level and graded terraces near Bushland, Tex. Each terrace type had advantages and disadvantages. The results varied for the different crops used and the types of soil on which the terraces were constructed.

3107. Hauser, V. L., and Zingg, A. W. CONSERVATION BENCHING—A NEW TERRACING TECHNIQUE SHOWS PROMISING RESULTS AT BUSHLAND. Soil and Water. 8(1): 12. 1959. 54.8 So3

A report was given on the construction and use of conservation benching in Texas.

3108. Hauser, V. L., and Zingg, A. W. A NEW TERRACING TECHNIQUE SHOWS PROMISING RESULTS AT BUSHLAND: CONSERVATION BENCHING. Grain Prod. News. 11(12): 8. Oct. 1959. 286.81 G764

A report was given on the use of conservation benching in Texas for surface drainage, reducing erosion, and utilizing runoff for crop production.

3109. Hays, O. E. TERRACES KEEP SOIL HOME. Hoard's Dairyman. 104(21): 1091, 1097. Nov. 10, 1959. 44.8 H65

A report was given on the construction and use of terraces in Ohio.

3110. Hays, O. E., and Attoe, O. J. CONTROL OF RUNOFF AND EROSION ON ALMENA SILT LOAM IN WISCONSIN. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-16, 19 pp. 1957. A56.9 R31

Eight years of runoff, soil loss, and yield data were presented showing the influence of row direction, strip cropping, and terracing on a gently sloping, poorly drained soil. The results indicated that contour strip cropping and terracing could be safely used on this poorly drained soil to reduce erosion and control runoff under a good soil management program without reducing crop yields.

3111. Hays, O. E., and Taylor, R. E. CONSERVATION METHODS FOR THE UPPER MISSISSIPPI VALLEY (FAYETTE SOIL AREA). U.S. Dept. Agr. Farm. B. 2116, 12 pp. illus. 1958. 1 Ag84F

The Fayette soil area is one of the most severely eroded farming areas in the North Central States. It comprises 12 million acres in southwestern Wisconsin, southeastern Minnesota, northeastern Iowa, and northwestern Illinois. It includes, Fayette, Dubuque, Clinton, and stony land, but is characteristically made up of grayish-brown, hilly silt loams.

This Farmers' Bulletin explains: The erosion damage; how crops affect erosion; how seasons affect erosion; and how to control erosion.

3112. Hendrickson, B. H., Barnett, A. P., and Beale, O. W. CONSERVATION METHODS FOR SOILS OF THE SOUTHERN PIEDMONT. U.S. Dept. Agr., Agr. Inform. B. 269, 18 pp. May 1963. 1 Ag84Ab

A discussion was given on the need and use of conservation for soils of the southern Piedmont Region.

3113. Hermsmeier, L. F., and Larson, C. L. LAND FORMING—A NEW WATER MANAGEMENT PRACTICE. Minn. Farm and Home Sci. 17(1): 8-9. 1959. 100 M668

A research report was given on the use of land forming for surface drainage.

3114. Hill, P. R. A SIMPLE SYSTEM OF MANAGEMENT FOR SOIL AND WATER CONSERVATION AND DRAINAGE IN MECHANIZED CROP PRODUCTION IN THE TROPICS. Empire J. Expt. Agr. 29(116): 337-349. Oct. 1961. 10 Em7

A report was given on the use of broadlands to control surface wash and improve drainage in the tropics of Africa.

3115. Hill, R. G. PAVE YOUR WATERWAYS WITH GRASS. Mich. State U. Ext., Ext. B. E-457, 2 pp. July 1964. 275.29 M58B

An illustrated guide was given on the construction, maintenance, and use of grass waterways in Michigan.

3116. Holmberg, G. VEGETATING CRITICAL AREAS. J. Soil and Water Conserv. 14: 165-168. 1959. 56.8 J822

Erosion control work is going to grass in Iowa's Little Sioux watershed—or more accurately to grass and legumes. The new grass program, teamed with terracing, mulch growing, and increased use of fertilizer, is helping farmers cut costs. With runoff reduced, only about half as many structures are needed as formerly.

The establishment and maintenance of vegetative cover on dams, basin terraces, borrow areas, waterways, and floodways, involves many different techniques. The methods must be easily applied, effective, and economical. These techniques are: (1) Growing mulch of small grain with a permanent grass-legume mixture; (2) fertilizing; (3) temporary diversions on critical areas; (4) level terraces on raw subsoil borrow areas located on hillsides before attempting to establish vegetation; and (5) use of reed canary grass in wet waterways and around ponds for wave action control.

3117. Howe, O. W., and Swanson, N. P. WHEN YOU BENCH-LEVEL FOR IRRIGATION; STOCKPILING WILL KEEP SURFACE SOIL ON TOP OF YOUR FIELD. Nebr. Agr. Expt. Sta. Q. 5(1): 8-9. 1957. 100 N27

A report was given on the advantages of saving the topsoil when land leveling to distribute back on top of areas of deep cuts.

3118. Hrcek, L. ESTABLISHMENT OF ORCHARDS ON SLOPES. (Se) Agron. Glasnik. 12(9/10): 790-795. 1962. 21.5 Ag84
German summary.

3119. Iancu, M., Stanculescu, A., and Olteanu, V. DIVERTING SURFACE WATER IN VINEYARDS AND ORCHARDS OF THE ARGES WATERSHED. (Rum) Gradina, Via si Livada. 9: 24-29. Sept. 1962. 80 G75
English summary on pp. 9-10 of supplementary pages.

A report was given on the use and need of surface drainage in vineyards and orchards in Rumania.

3120. Ichinohe, S. EROSION CONTROLLING EFFECTS OF RIDGING IN CONTOUR CROPPING. (Ja) (Abs.) Crop Sci. Soc. Japan Proc. 25: 55. Oct. 1956. 22.5 C88

3121. Ionescu, V., and Ionescu, V. SOME PROBLEMS OF SPRINKLER IRRIGATION OF GRAPES PLANTED ON TERRACED SLOPES. (Rum) Gradina, Via si Livada. 13(7): 16-25. July 1964. 80 G75

3122. Irwin, R. W., and Hore, F. R. ASSESSMENT AND PAYMENT FOR DRAINAGE WORK IN CANADA. Cong. Irrig. and Drain. Trans. 5(2): R.15.1-R.15.8. 1963. 55.9 C7652

A report was given on the assessment and payment for the different types of drainage work in Canada. Individual owners are responsible for the surface drainage and tile drainage on their own lands. For Municipal drains, the Provincial government provides a subsidy of one-third of the cost. The remaining cost may be financed by debenture, and is paid by the land owners.

3123. Jacobson, P. NEW METHODS OF BENCH TERRACING STEEP SLOPES. Trans. ASAE 6(3): 257-258, 261. 1963. 290.9 Am32T

A discussion was given of a new method proposed for developing bench terraces on steep slopes in Iowa. When first constructed, this type of terrace will look like a regular terrace except that the downhill slopes will be seeded. The natural process of erosion will bench the land.

3124. Jacobson, P., and Weiss, W. FARMING TERRACED LAND. U.S. Dept. Agr. L. 335, slightly rev., 16 pp. Feb. 1961. 1 Ag84L

A report was given on the farming and maintenance of terraced land.

3125. Johannes, R. SURFACE DRAINAGE IS PROFITABLE. Hoard's Dairyman. 106(13): 665, 686. July 10, 1961. 44.8 H65

An illustrated report was given on the use and construction surface drainage.

3126. Jones, B. A., Jr. GULLY CONTROL WITHOUT STRUCTURES—PART II. Trans. ASCE 6(1): 39-40, 47. 1963. 290.9 Am32T

Three years after a research report was presented on gully control without structures, the five areas were inspected in the fields and the results of each inspection were given.
It was concluded that the vegetated outlets sections for use in terminating grassed waterways were feasible provided the assumed conditions were met and routine maintenance was performed.

3127. Jones, B. A., Burwell, R. E., Atkinson, H. B., Hay, R. C., and Van Doren, C. A. EFFECT OF FARMING ACROSS TERRACES IN STRAIGHT-ROW FIELD OPERATION. Trans. ASAE 2(1): 115-117, 119. 1959. 290.9 Am32T

A report was given on the use and maintenance of broadbase terraces in Illinois when they are farmed in straight-row operations across the terraces.

3128. Kalmykov, S. S. CONQUERING VIRGIN SLOPES. (Rus) Sadovodstvo. 11: 14-15. 1963. 80 Sa13

3129. Khairullin, S., and Artemov, N. ECONOMIC EFFECTIVENESS OF LEVELLED SUBSOILING. (Rus) Ekon. Sel'sk. Khoz. 9: 104-109. Sept. 1963. 281.8 So73

3130. Kiehle, J. D., and Mason, W. A., Jr. GRAPE GROWERS—AREAS GAIN FROM CONSERVATION. Soil Conserv. 29(2): 36-37. 1963. 1.6 So3S

A report was given on the need and use of conservation practices—especially contouring and drainage—for grape and peach production in New York.

3131. Kienitz, G. A HYDROLOGICAL AND EFFICIENCY INVESTIGATION METHOD IN CONNECTION WITH THE ESTABLISHMENT OF THE DEVELOPMENT RATE OF SURFACE DRAINAGE. Cong. Irrig. and Drain. Trans. 5(3): R.15.495-R.15.504. 1963. 55.9 C7652

A report was given on a hydrological and efficiency investigation method used in connection with the establishment of the development rate of surface drainage in Hungary.

3132. King, K., and Hastie, E. L. RECENT DEVELOPMENTS IN STABILIZING WATERWAYS. Queensland Fruit and Veg. News. 9: 494. Apr. 19, 1956. 280.38 Q3

A report was given on the use of tarred waterways for contour planting of pineapples in Australia.

3133. Kirkpatrick, J. W. A FARMER'S EXPERIENCE WITH LAND FORMING IN ALLUVIAL AREAS. Cott Mech. Annu. Conf. Proc. 11: 20-21. 1957. 281.3729 B41

A report was given on the use of land forming for the drainage of irrigated lands in alluvial areas of Arkansas.

3134. Knoop, F. ROLL-OVER TERRACES. Farm Q. 11: 83-85, 132-134. Spring 1956. 6 F22995

A report was given on the use of "V" type terraces in Nebraska.

3135. Kochkin, M. A., and Donyushkin, V. I. SOIL EROSION CONTROL IN THE MOUNTAIN AREA OF CRIMEA. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 11: 53-55. Nov. 1963. 20 V633

3136. Konstantinov, I. S., and Fedotov, V. S. AN EXPERIMENT IN TERRACING SLOPES IN THE RUMANIAN PEOPLE'S REPUBLIC. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1960(3): 64-65. May/June 1960. 80 Sa15

3137. Kosac, S. LAND BARRIERS IN RUNOFF IN ITALY. (Se) Sumarstvo. 10(11/12): 786-790. 1957. 99.8 Su63

3138. Koszeghy, G. TERRACING OF SLOPE FOR FRUIT PLANTING. (Hu) Kerteszet es Szoleszet. 13(6): 14-15. Mar. 1964. 80 K474

3139. Koval', L. I., and Fostikov, A. T. UTILIZATION OF SLOPES WITH MINIMUM EXPENDITURES. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1961(5): 33-36. May 1961. 80 Sa15

3140. Krishnan, R. H., Subramanyam, A., and Sivaprakasam, K. RIDGING TRIAL IN PADDY. Madras Agr. J. 51(1): 32-33. Jan. 1964. 22 M262

A report was given on the effect of ridging in paddy fields of India.

3141. Kuder, G. LAND-SHAPING—SCOPE OF PLAN FOR HARTSFELD. (Ge) Wurttemb. Landesstelle f. Natschutz. u. Landschaftspflege. Veroffentl. 29: 15-99. maps. Ref. 1961. 410.9 W96

3142. Lakshmipathy, B. M., and Narayanaswamy, S. BENCH TERRACING IN THE NILGIRIS. J. Soil and Water Conserv. India. 4(4): 161-168. July 1956. 56.8 J824

A report was given on the design and use of bench terrace in Nilgiris.

3143. Landers, R. H. LAND GRADING RAISES YIELDS AND BENEFITS RURAL ECONOMY. Soil Conserv. 29(11): 261-262. June 1964. 1.6 So3S

A report was given on the value of land grading in Missouri.

3144. Langa, J. M. SOME EFFECTS OF LAND FORMING ON FURROW IRRIGATION AT HC & SCO [HAWAIIAN COMMERCIAL and SUGAR COMPANY]. Hawaii Sugar Tech. Proc. 18: 49-53. 1959. 65.9 H317

A progress report was given on some effects of land forming on furrow irrigation on sugarcane fields in Hawaii.

3145. Langa, J. M. LAND FORMING AND LEVEL LEVEL DITCH IN RELATION TO SURFACE IRRIGATION AT H. C. & S. CO. Hawaii Sugar Tech. Rpt. 19: 50-53. 1960, pub. 1961. 65.9 H317

A discussion was given on land forming and the use of the level level ditch for surface irrigation on sugarcane fields in Hawaii.

3146. Latham, B. M. NO TERRACES—JUST CONTOUR STRIPS. Soil Conserv. 25: 157. 1960. 1.6 So3S

On the Charles McIlwain farm in Abbeville County, S.C., there isn't a single terrace—they used to be there, but they have been eliminated. Contour strip rotations, with strips 72 feet wide, are used instead of terraces. Every other strip is in small grain. This system gives adequate rotation to protect the Class II land and at the same time, if properly laid off, will give all long rows.

With the parallel strips, McIlwain uses every natural depression for a grass waterway. The meadows used for drainage are small and the cultivating equipment can cross them without difficulty. He just elevates the plow blade when he comes to one, crosses the meadow and continues the cultivation of the crops.

3147. Lawhon, L. F. WATER LEVELING ON RICELAND. Trans. ASAE 5(2): 202-203. 1962. 290.9 Am32T

A report was given on the use of water leveling on riceland. As a technical assistance, a 0.2-ft. interval contour map was desirable as a starting point where the land has not been in rice previously. Where the land had been in rice, existing levees were used as a contour map for planning the location of new levees.

3148. Little, W. C. COST OF PARALLEL TERRACES DEPENDS LARGELY ON AMOUNT OF EARTHMOVING. Soil Conserv. 29(11): 249-250. June 1964. 1.6 So3S

A report was given on the cost of parallel terraces in the Piedmont area of Georgia and South Carolina.

3149. Livermore, D. E. HEADLAND DRAINS. Victorian Hort. Digest. 8(1): 15-16. Autumn 1964. 80 V662

A report was given on the use of surface drainage in headland drains for orchards in Australia. Some of these drains are used as diversion drains to drain the area into ponds.

3150. Longworth, L. D. GRASSED FLUMES IN GULLY CONTROL. N. S. Wales Soil Conserv. Serv. J. 20(2): 60-66. Apr. 1964. 56.9 N472

A report was given on the construction and use of grassed flumes for gully control in New South Wales.

3151. Lotan, A. GRASS-COVERED WATERWAYS. (He) Hassadeh. 37(9): 798-799. June 1957. 26 H27

3152. Lotan, A. GRASS-COVERED WATERWAYS. (He) Hassadeh. 37(10/11): 881-884. July/Aug. 1957. 26 H27

3153. Lotan, A. SURFACE DRAINAGE. (He) Israel Dept. Agr. Ext. Serv. Agr. P. Div. [P.] 60, 32 pp. 1964. 275.249 Is7

3154. Lujic, R. CONTOUR TRENCHES AND THEIR APPLICATION IN GRDELITZA CANYON. (Se) Sumarstvo. 8: 403-420. July/Aug. 1955. 99.8 Su63
English summary.

A report was given on some contour trenches (terraces) used in orchards in Yugoslavia.

3155. L'vin, N. S. BUILDING IMPROVED TERRACES. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1961(1): 16-18. Jan. 1961. 80 Sa15

3156. Lyles, L., and Heilman, M. D. USING DRAINAGE DITCH SPOILBANKS IN LANDFORMING OPERATIONS IN TEXAS. J. Soil and Water Conserv. 19(2): 79-80. Mar./Apr. 1964. 56.8 J822

A generally accepted standard for the use of spoilbank material in leveling cropland would be that such material have the characteristics needed for sustained high-level production of crops. The available phosphorous and salinity status of the 24 spoilbanks studied indicated that about 80 percent of the banks would not meet such a standard unless corrective measures were applied.

3157. McAlister, J. T., and Aull, J. L. TERRACING IN SOUTH CAROLINA. J. Soil and Water Conserv. 15(5): 225-228. Sept. 1960. 56.8 J822

The development of terracing in South Carolina was traced from the first use of hillside ditches to present day terrace construction and use.

3158. McKeever, I. TERRACING; OLD PRACTICE GOES MODERN. Soil Conserv. 28(2): 29-30. Sept. 1962. 1.6 So3S

A history of terracing was given along with a discussion of the modern type broad base diversion terraces now used in Pennsylvania.

3159. McRae, E. A. DRAINAGE PROBLEMS IN THE BOEUF-TENSAS BASIN. Agr. Engin. 45(9): 488-489, 491. Sept. 1964.

A report on the drainage problems in the Boenf-Tensas Basin in Arkansas was given. Methods used to correct these problems were discussed.

3160. Maltabar, L. M., Nekrasova, A. A., and Petrash, D. N. AVOID MISTAKES IN RECLAMATION OF SLOPES FOR VINEYARDS. (Rus) Sadov. Vinograd i Vinodel. Moldavii. 1961(3): 41-42. Mar. 1961. 80 Sa15

3161. Marrero, J. F. CONSERVATION HELPS BRING BACK PUERTO RICO'S COFFEE PRODUCTION. Soil Conserv. 29(2): 43-44. 1963. 1.6 So3S

A report was given on the need and use of field diversion ditches, terraces, permanent sod waterways and other soil conservation practices for raising coffee in Puerto Rico.

3162. Medelana, D. R. D. DRAINAGE OF HILL AND MOUNTAIN LANDS. (It) Rass. dell'Agr. Ital. 16(5): 32-33. May 1961. 281.8 R18

3163. Medlock, O. C. IMPROVED WATER-DISPOSAL SYSTEMS. Better Crops Plant Food. 39(8): 13-14, 42-43. Oct. 1955. 6 B46

A report was given on the before and after pictures of changing from regular terraces to parallel terraces plus odd areas seeded to grass on a farm near Barnwell, Ala.

3164. Mihalache, L. CONTROL OF SOIL EROSION IN VINEYARDS BY BUILDING SMALL TERRACES. (Rum) Bucharest. Inst. de Cercet. Horti-Vitic. Lucrari Sti. 1959/60: 67-72. 1961. 86 R862
French summary.

3165. Mihalache, L., and Protopopescu, V. A METHOD OF PREPARING TERRACED TERRAINS FOR NEW PLANTING OF GRAPES IN THE GRAPE-GROWING AREA OF DEALUL MARE. (Rum) Baneasa. Inst. de Cercet. Horti-Vitic. Lucrari Sti. 1958/59: 175-183. 1960. 86 B22
French summary.

3166. Miller, J. TERRACES IN MADISON COUNTY. Iowa Soil and Water. 6(1): 18. Mar. 1958. 290.8 Io9

A report was given on the use and construction of SCS terraces in Madison County, Iowa.

3167. Mort, G. W. SOIL CONSERVATION ON THE NORTH COAST. N. S. Wales Soil Conserv. Serv. J. 12: 14-21. Jan. 1956. 56.9 N472

A report was given on some methods of soil conservation used in New Zealand. The use of graded banks (terraces), deep ripping, and contour pasture furrows were stressed. Contour planting of orchards and bananas were discussed.

3168. Muresan, D., Titz, L., Onea, T., and Popescu, V. OBSERVATIONS ON THE EXECUTION AND THE USE OF TERRACES FOR VINE CULTURES IN THE CLUJ REGION. (Rum) Cluj. Inst. Agron. "Dr. Petru Croza." Lucrari Sti. 18: 91-97. 1962. 21 C622
English summary.

A report was given on observations on terraces for vine culture in the Cluj Region of Rumania.

3169. Nakamura, C., Tanabe, H., Kita, S., and Konno, N. STUDIES ON THE METHOD OF TERRACING ON SLOPING LAND. I. - III. (Ja) Shikoku Agr. Expt. Sta. B. 6: 347-380. maps. Ref. Mar. 1962. 107.6 Z4

3170. Nekrasova, A. A., and Piskarev, A. N. GROWING GRAPES ON SLOPES. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1960(1): 22-26. Jan./Feb. 80 Sa15

3171. Neto, J. A. TERRACING AND ITS ADVANTAGES. (Por) Minas Gerais. Dept. de Prod. Veg. B. de Agr. 5(5/6): 31-33. May/June 1956. 9.2 M663

3172. New South Wales Soil Conservation Service. CONTOUR FURROWING. Sydney. 8 pp. 1954. 56.7 N47Co

A report was given of the use of contour furrowing for pastures and orchards in Australia.

3173. Nicholson, A. J. CONTOUR FURROWING. So. Australia Dept. Agr. J. 65(12): 514-519. July 1962. 23 So84

A report was given on the use and construction of contour furrows in pasture and cropland in Australia.

3174. Nonaka, S., Kagawa, S. I., and Kagawa, K. STUDIES ON THE SIMPLE WAY OF MAKE TERRACE USING PASTURE. (Ja) Shikoku Agr. Expt. Sta. B. 7: 185-196. Dec. 1962. 107.6 Z4
English summary.

A report was given on a simple way to make terraces by planting grass on the contour on steep slopes on cultivated fields in Japan.

3175. Oliferov, A. N. SOIL WATER OF THE TERRACED SLOPES. (Rus) Sad i Ogorod. 9: 48-50. Sept. 1955. 80 Sa13

3176. Owen, W. H. THE NEW LOOK IN TERRACING. Land Impr. 6(4): 12-15. Apr. 1959. 282.8 L224

A report was given of the new efficient terracing methods. The use of parallel terracing, conservation benching, and contour bench leveling were described.

3177. Pasini, B. HYDRAULIC-AGRARIAN MANAGEMENT OF FERRARA RICE FIELDS. (It) Agr. Ferrarese. 62(1): 6-11. (Cont.) Jan. 31, 1958. 16 Ag87

3178. Patil, B. D. THERE IS MUCH IN CONTOUR FURROWING. Farmer (Bombay). 7(4): 7-10. Apr. 1956. 22 F22

The use of contour furrowing was discussed for grassland in India. Reference was made to contour furrowing in the United States.

3179. Peev, B. METHODS OF TERRACING. (Bu) Vissh Selskostopanski Inst. "Georgi Dimitrov." Agron. Fakul. Nauch. Trudove. 12: 387-408. Ref. 1963. 106.3 Se4N
German summary.

3180. Pena, R. SOIL CONSERVATION BY TERRACING. (Sp) Nuestra Tierra. 5(45): 95-96. Mar./Apr. 1961. 8 N882

3181. Peterson, D. G. LAND FORMING-FIRST STEP TO BETTER AND BIGGER CROPS. World Farming. 1(1): 13-19. Jan. 1959. 30.08 W89

A report was given on land forming for surface drainage of irrigated land.

3182. Phillips, R. L. LAND LEVELING FOR DRAINAGE AND IRRIGATION. Agr. Engin. 39(8): 463-465, 470. Aug. 1958. 58.8 Ag83

A report was given on a system of land leveling to provide, in one system, both surface drainage and surface irrigation on Missouri River bottom land to give farmers in Iowa double insurance—against the hazards of either a wet or dry year.

3183. Phillips, R. L. SURFACE DRAINAGE SYSTEMS FOR FARM LANDS (EASTERN UNITED STATES AND CANADA). Trans. ASAE 6(4): 313-317, 319. 1963. 290.9 Am32T

A report was given of the ASAE Surface Drainage Committee covering the principles of surface drainage and the different types of drainage systems. A number of drainage terms were defined and surface drainage systems in present use in the Eastern United States and Canada were described.

3184. Pisarenko, A. J. TERRACING IN NORTHERN CAUCASUS. (Ge) Sozialistische Forstwirtsch. 14(12): 382-385. Dec. 1964. 99.8 W143

3185. Plantie, L. FRENCH ALGERIAN TECHNIQUE FOR PROTECTIVE TERRACES AND RESTORATION OF SOILS. (Fr) Algeria Dir. de l'Agr. et des Forets. Agr. Algerienne. 5: 61-74. (Cont.) Feb. 1961. 24 AL395.

3186. Pompa, P. G. THE THIRD DRAINAGE NETWORK IN THE IRRIGATED ZONE OF THE D'ORELLANA CANAL IN THE BADAJOZ PLAINE. (Fr) Internatl. Cong. Agr. Engin. 6(2): 176-180. 1964.

A report was given on the drainage of irrigated land in Spain by terracing and deep plowing.

3187. Ponimash, P. I. EXPERIMENT WITH THE FURROW-TERRACE METHOD. (Rus) Sad i Ogorod. 4: 22-25. Apr. 1956. 80 Sa13

3188. Popa, V. MIXED CROPS ON BENCH TERRACES IN PREMOUNTAINOUS REGIONS. (Rum) Fradina, Via si Livada. 9(6): 61-66. June 1960. 80 G75
English summary.

A report was given on the use and construction of bench terraces in Rumania for fruit trees. Vegetable crops and small fruit crops are planted with the fruit trees for the first few years to obtain extra income from the area.

3189. Popov, T. EFFECT OF CONDITIONS OF BENCH-FORMED TERRACES AND FERTILIZING BEFORE PLANTING ON THE GROWTH OF YOUNG GRAPEVINES RAISED ON SLOPES. (Bu) Pleven. Tsent. Nauchizsled. Inst. po Lozarstvo i Vinarstvo. Izv. 2: 49-85. Ref. 1962. 95.9 P712
French summary.

3190. Popovich, P. D. TERRACING SLOPES. (Rus) Sadovodstvo. 3: 18-19. Mar. 1964. 80 Sa13

3191. Porter, H. L. ESTABLISHING GRASS WATERWAYS. J. Soil and Water Conserv. 14(5): 211-213. Sept. 1959. 56.8 J822

A report was given on establishing and maintaining grassed waterways on the fragipan soil areas of New York and Pennsylvania during 1955-57.

3192. Proskuryakova, O. F., and Pisarenko, E. P. AN EXPERIMENT IN THE AFFORESTATION OF STEEP MOUNTAIN SLOPES IN THE CAUSASIAN MINERAL WATER DISTRICT. (Rus) Lesn. Khoz. 1961(8): 42-46. Aug. 1961. 99.8 L5622

3193. Prott, H. INCLINED DITCHES AND GRASSLAND AS PROTECTION AGAINST SOIL EROSION BY SURFACE WATER. (Ge) Schrreihe. f. Flurbereinigung. 22: 68-70. 1959. 282.9 Sch7

3194. Purnell, W. F., and Jones, B. A. SAVE SOIL WITH GRASS WATERWAYS. Ill. U. Agr. Ext. C. 810, 16 pp. Oct. 1959. 275.29 IL62C

An illustrated report was given on the use and construction of grass waterways in Illinois.

3195. Ree, W. O. CONTROL OF WATER FLOW THROUGH VEGETATIVE LININGS. Ohio State U. Short Course Roadside Devlpmt. 17: 86-91. 1958, pub. 1959. 288.9 Oh3

A report was given of the testing and use of grassed waterways to reduce erosion in Oklahoma.

3196. Ree, W. O. THE ESTABLISHMENT OF VEGETATION LINED WATERWAYS. Ohio State U. Short Course Roadside Devlpmt. 19: 54-65. 1960, pub. 1961. 288.9 Oh3

A report was given on the establishment of vegetationed lined waterways. Six channel liners designed for temporary protection of new graded waterways were described and illustrated.

3197. Roberts, E., Phagan, C. V., Bunch, C., and Chiles, R. E. ESTABLISHING AND MAINTAINING GRASS WATERWAYS. Okla. State U. Agr. Ext. C. E-702, 11 pp. map. Mar. 1960. 275.29 Ok41C

A report was given on the establishment and maintenance of grass waterways in Oklahoma.

3198. Roberts, J. T. BEFORE YOU LEVEL, WET IT DOWN. Land Impr. 3(4): 12-14. Apr. 1956. 282.8 L224

An illustrated report was given on land leveling in the Columbia Basin area of Washington. Presprinkling saved 20 to 30 percent of the leveling cost in addition to the advantages of moist ground for the farmer to start work. Presprinkling cost $5 to $7 an acre. Areas not sprinkled settled irregularly and sometimes needed additional leveling.

3199. Robins, J. S. TERRACE BENCHING AND LAND LEVELING TO CONSERVE MOISTURE. Great Plains Agr. Council Proc. 1960: 97-103. 282.9 G7992

A report was given on the use of terrace benching and land leveling to conserve runoff on non-irrigated lands and the potential for such systems in the Great Plains of the United States.

3200. Robinson, G. K. WATERWAYS—KEY TO SUCCESS WITH CONTOUR BANKING. So. Australia Dept. Agr. J. 59: 343-345. Apr. 1956. 23 So84

A report was given on the construction and use of grassed waterways for contour banks (terraces) in South Australia.

3201. Rocha, M. S. D. TERRACING. (Por) Rev. Agron. [Lisboa] 40: 48-63. 1957. 15.5 R32

3202. Rosser, J. MACKAY CANE GROWERS USE CONTOUR BANKS TO CONTROL EROSION. Queensland Bur. Sugar Expt. Sta. Cane Growers' Q. B. 25(1): 13-16, 21-23. July 1, 1961. 65.9 Q3C

A report was given on the use of contour banks (terraces) for growing sugarcane in Australia.

3203. Rosser, J. WATERWAY ESTABLISHMENT ON RED BASALTIC SOILS. Queensland Agr. J. 87(9): 548-553. Sept. 1961. 23 Q33

A report was given on the establishment of waterways for contour farming on the red basalic soils in Australia.

3204. Rustamov, G. G. IMPROVING THE EFFECTS OF SURFACE DRAINAGE OF IRRIGATED LANDS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 49-58. 1962. 20 M857

3205. Rustamov, G. G. EFFECTIVENESS OF HORIZONTAL SURFACE DRAINAGE OF IRRIGATED LANDS IN THE AZERBAIJAN SSR. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 59-65. 1962. 20 M857

3206. Sakhonchik, V. ESTABLISHMENT OF SMALL DITCHES ON SLOPES. (Rus) Sel'sk. Khoz. Sibiri. 1960(10): 51-53. Oct. 1960. 20 Se492

3207. Saveson, I. L. PRECISION SURFACE DRAINAGE FOR CANE LAND. Sugar J. 18(11): 29-31. Apr. 1956. 65.8 Su391

A report was given on precision surface drainage for sugarcane land in Louisiana. The grading and leveling cost varied from $45 to $100 per acre. In many cases this cost was liquidated by increase yields the first year.

3208. Saveson, I. L. PRECISION SURFACE DRAINING FOR CANE LAND. Sugar. 51(8): 30-32. Aug. 1956. 65.8 F11

A report was given on the use of precision surface drainage in sugarcane fields in the United States.

The improved system retained the lateral ditches of the old drainage system but reduced the quarter drains or field drains to mere openings through the rows. Final benefits were lower cost drainage and higher sugar yields.

3209. Saveson, I. L. PRECISION SURFACE DRAINAGE FOR SUGAR-CANE LAND. World Crops. 8: 309-310, 319. Aug. 1956. 281.8 W892

A report was given on the precision surface drainage method for sugarcane land in Louisiana.

3210. Saveson, I. L. LAND FORMING FOR DRAINAGE IN LOUISIANA. (Abs.) Assoc. Southern Agr. Workers Proc. 54: 50-51. 1957. 4 C82

A report was given on the following three types of land forming in Louisiana: (1) Sugarcane land that is divided into cuts from 150-250 feet wide and approximately 1000 feet long; (2) pasture land that is generally formed into beds by the use of motor graders from the earth that is excavated in providing a flat shaped ditch on each side of the bed; and (3) general cropland consisting of larger areas requiring more surveying and staking.

3211. Saverson, I. L. LAND FORMING IN ALLUVIAL AREAS. Cotton Mech. Annu. Conf. Proc. 11: 19-20. 1957. 281.3729.3729 B41

A report was given on the need and use of land forming in alluvial areas for row cropland in Arkansas, Louisiana, and Mississippi.

3212. Saverson, I. L. LAND FORMING IN ALLUVIAL AREAS. Cotton Gin and Oil Mill Press. pp. 36-37. Oct. 19, 1957. 30.47 C82

A report was given on the need and use of land forming in alluvial areas for row cropland in Arkansas, Louisiana, and Mississippi.

3213. Saveson, I. L. LAND FORMING IN ALLUVIAL AREAS. Soil Conserv. 23(12): 245-249. July 1958. 1.6 So3S

A report was given on research studies on land forming in Louisiana, and Mississippi.

3214. Saveson, I. L. LAND FORMING FOR DRAINAGE. Agr. Engin. 40(4): 208-209, 213. Apr. 1959. 58.8 Ag83

The practice of smoothing and shaping land to facilitate the removal of excess rainfall was described and illustrated.

3215. Saveson, I. L. AN EFFICIENT DRAINAGE SYSTEM FOR SUGARCANE. The Sugar B. 42(3): 30-32. Nov. 1963. 65.9 Am32

A discussion was given on the use of precision land forming for an efficient drainage system for sugarcane.

3216. Saveson, I. L., and Jones, G. W. LAND LEVELING. Farm Mech. 10(106): 132-133. Apr. 1958. 58.8 B772

Mr. Saveson reported on land leveling research for surface drainage in the alluvial areas of the United States and Mr. Jones reported on experiences with land leveling in Great Britian on heavy fen land farms.

3217. Schaller, F., Jacobson, P., Hull, D. O., and Willrich, T. GRASSED WATERWAYS AND TERRACE OUTLETS. Iowa State U. Sci. and Tech., Coop. Ext. Serv. Pamphlet 166 (Rev.), 8 pp. 1962. 275.29 Ia9Pa

Almost every sloping field has natural draws or waterway channels where water concentrates and runs off the field. When these waterway channels are not protected by grass, they often become small gullies in a short time.

An illustrated and descriptive guide was given on the making and maintenance of grassed waterways.

3218. Schiechtl, H. M. SLIDE SLOPES MUST BE FORTIFIED, LATEST ON GREEN DAMMING. (Ge) Orion. 13(11): 907-914. Nov. 1958. 474 Or4

3219. Serikov, I. M. TERRACING OF MOUNTAIN SLOPES. (Rus) Lesn. Khoz. 1960(2): 53-56. Feb. 1960. 99.8 L5622

3220. Sewell, J. I., and Hazlewood, B. P. LAND FORMING—A NEW PRACTICE FOR TENNESSEE. Tenn. Farm and Home Sci. Prog. Rpt. 48: 2-3. Oct./Dec. 1963. 100 T25F

A report was given on the use of landforming for surface drainage in Tennessee.

3221. Shearer, M. N. DRAINAGE AROUND HOMES ON SLOPING GROUND. Oreg. State Col. Ext., Ext. C. 608, 6 pp. folder. May 1956. 275.29 Or32C

A report was given on the use of drainage around homes built on sloping grounds in Oregon.

3222. Sheng, T. SANDY STONE HOLLOW. China Reconstructs. 11(10): 2-6. Oct. 1962. 280.8 C447

A report was given of the development of an area in China by the use of stone bench terraces and the addition of soil to the area between the terraces.

3223. Sheppel', P. A. ON THE PROPER LEVELING OF DIKED LAND IN THE VOLGAAKHTUBA FLOOD PLAIN. (Rus) Sel'sk. Khoz. Povolz'ia. 2(9): 33-35. Sept. 1957. 20 Se478

3224. Shileika, V. I. MOUNTAIN DRAINAGE IN LITHUANIA SSR. (Rus) Gidrotekh. i Melior. 8(12): 27-36. Dec. 1956. 290.8 G362

3225. Shults, J. D. WATER LEVELING IN ARKANSAS. Rice J. 67(10): 10-11. Sept. 1964. 59.8 R36

A report was given on leveling of rice land in Arkansas when the field is under water. The leveling was faster and more economical than leveling dry fields. The leveling was adapted only to rice soils that had a substantial hard pan that supported the weight of the leveling equipment.

3226. Sisson, D. R. A DRAINAGE INVENTORY FOR ONE STATE. Land Impr. 5(4): 20-22. Apr. 1958. 282.8 L224

A report was given on the drainage needs of Indiana. Both tile drainage for subsurface drainage and land smoothing for surface drainage were discussed.

3227. Sisson, D. R. GRASS WATERWAYS. Purdue U. Ind. Agr. Ext., Ext. C. 453, 8 pp. 1958. 275.29 In2E

An illustrated guide was given on the construction and use of grass waterways in Indiana.

3228. Sisson, D. R. KEEP YOUR SOIL HOME WITH TERRACES. Hoard's Dairyman. 106(18): 890, 906. Sept. 25, 1961. 44.8 H65

A report was given on the value of terraces for erosion control and moisture conservation.

3229. Sisson, D. R., and Galloway, H. M. SURFACE DRAINAGE ON CLERMONT SILT LOAM. Ind. Agr. Exp. Sta. Res. Prog. Rep. 159, 6 pp. map. Dec. 1964. 100 In2Res

A five year study in Indiana was reported that compared the land smoothing system of surface drainage with that of bedding. Land smoothing gave more complete drainage, higher stands, more uniform crop growth and yield, was more convient to farm, and except for the land leveler, it can be installed with regular farm equipment.

3230. Sitnikov, A. M. LEVELLING AND COMPRESSING PLOWED FIELD FOR WINTER FALLOWING. (Rus) Zemledelie. 8: 25-27. Aug. 1964. 20 Z44

3231. Smith, D. D. TIME STUDY OF PARALLEL TERRACES. Agr. Engin. 37(5): 342-345. Ref. 1956. 58.8 Ag83

A report was given on the advantages of parallel terraces.

3232. Smith, K. J. BITUMEN SEALING FOR FLUMES AND WATERWAYS. N. S. Wales Soil Conserv. Serv. J. 16(1): 31-40. Jan. 1960. 56.9 N472

A report was given on the use of bitumen sealing for flumes and waterways and seeding them to grass for grass waterways in Australia.

3233. Smith, R. M., Bennett, A. C., and Henderson, R. C. RESEARCHERS REPORT ON PARALLEL-TYPE TERRACES. Soil and Water (Assoc. Tex. Soil Conserv. Dist.) 8(5): 7, 17, 19. 1959. 54.8 So3

Parallel-type terraces in the Blackland may mean fewer point rows, reduced erosion between terraces; and less concentration of water at outlets, if farmers are willing to break their fields with grassed waterways at intervals of 1,200 feet or less and to pay a moderate price for land smoothing.

These conclusions were supported by results and experiences on the Blackland Experiment Station near Temple, where a complete system was planned and established on Houston Black clay and Austin clay soils. The 50-acre field involved was definitely not hand picked for ease of installation. Slopes on this field vary from less than 1 percent to more than 5 percent.

3234. Sparrow, G. N., Long, F. L., and Daniels, J. M. WATER CONTROL ON BLADEN SOIL. Trans. ASAE 7(3): 313-315. map. 1964. 290.9 Am32T

A report was given on the use of surface drainage plus subsurface drainage on Bladen fine sandy loam for water management in Georgia.

3235. Spurrier, E. C. MAKE GRASS WATERWAYS TO PREVENT GULLIES. Hoard's Dairyman. 102(10): 532. May 25, 1957. 44.8 H65

The making of grassed waterways to prevent gullies was discussed.

3236. Staff Writer. TERRACING GROWS UP: THE EVOLUTION OF A BASIC LAND PRACTICE. Land and Water Contract. 6(6): 6-9. 1964. 56.8 L222

New technological developments are launching a revolution in terracing to the gratification of farmers and land and water improvement contractors. A review of the evolution of terracing was given for the contractor.

The following types of terraces were discussed: (1) "Push-up" terraces; (2) parallel terraces (3) bench terraces; (4) level terraces with tile outlets; and (5) Zingg terraces.

3237. Stancu, T., and Protopopescu, V. A METHOD OF PREPARING TERRACED TERRAINS FOR NEW PLANTING OF GRAPES IN THE WINE GROWING COUNTRY OF DRAGASANI. (Rum) Baneasa. Inst. de Cercet. Horti-Vitic. Lucrari Sti. 1958/59: 185-193. 1960. 86 B22
French summary.

3238. Stanislawski, D. AGRICULTURAL TERRACES IN PORTUGAL. (Abs.) Assoc. Amer. Geog. Ann. 46: 273. June 1956. 500 As73

An abstract was given of an article on the use of agricultural terraces in Portugal.

3239. Stephens, R. M. DEVELOPING A TOBACCO FARM ON THE CONTOUR. Australia Tobacco J. 3: 6-7. July 1962. 69.8 Au7

A report was given of methods used to develop a tobacco farm on the contour (terraces) in Australia.

3240. Stephens, R. M. GRASS COVER FOR WATERWAYS. Australia Tobacco J. 4: 26, 28, 30. July 1963. 69.8 Au7

A discussion was given of need and development of grassed waterways for tobacco production in Australia.

3241. Stewart, K. V. WATER LEVELING RICE LAND. Rice J. 67(5): 29-31. May 1964. 59.8 R36

A report was given on leveling of rice land when it is under water in Louisiana. The soil material has to have sufficient strength to support mechanical earth moving equipment when the top 4 to 6 inches of soil is saturated.

3242. Stewart, K. V., Jr. WATER LEVELING LOUISIANA RICELAND SAVES LABOR AND IRRIGATION WATER. Soil Conserv. 29(11): 257-258. 1964. 1.6 So3S

A report was given on the advantages of leveling Louisiana riceland when it is under water.

3243. Stewart, K. V., Jr., and Saveson, I. L. SYSTEMS FOR DRAINING THE SURFACE. U.S. Dept. Agr. Ybk. Agr. 1955: 499-507. 1955. 1 Ag84Y

Methods of surface drainage were given. The type of drainage system used is determined by: The topography; the type of farming; and the kinds of crops grown. The following types of drainage systems were explained: Regular or parallel; random; bedding; cross slope; field ditch; sugarcane; and the rice drainage system.

3244. Stranski, I., Milchev, M., and Andonov, T. THE PLOUGHING TERRACES IN BULGARIA. (Bu) Bulgaria Akak. na Nauk. Poch. Inst. Izv. 7: 87-112. 1960. 56.9 B871
English summary.

A report was given the use of plowed terrace in Bulgaria.

3245. Symposium. SYSTEMATIZING OF THE LAND. (It) Agricoltura. 8(3): 37-51. Mar. 1959. 16 Ag8226

3246. Takahashi, K. DRIFTED SNOW AND TERRACED FORESTS. (Ja) Ringyo Gijitsu. 256: 13-16. July 1963. 99.8 R473

3247. Taylor, G. S. HINTS ON FARMING POORLY-DRAINED CLAY SOIL. Hoard's Dairyman. 103(7): 372-373. Apr. 10, 1958. 44.8 H65

The drainage and tillage of poorly-drained clay soils were discussed. Surface drainage along with tile drainage was recommended.

3248. Touwen, L., and Versteeg, W. SPORT FIELDS. II. (Du) Koninklijke Nederland Heidemaatsch. Tijdschr. 75(7/8): 353-360. July/Aug. 1964. 12 N282

3249. Tsunematsu, S., Yoshida, T., and Nambu, S. STUDIES ON THE AVAILABLE USES OF PAN-BREAKER. VI. (Ja) Soc. Agr. Mach. Japan J. 24(4): 190-193. Mar. 1963. 58.9 So1
English summary.

A report was given on the use of a pan-breaker in Japan on swamp land to promote surface drainage.

3250. Uotila, P. J. THE SURFACE LEVELING AND GRADING OF TILLED FARMLAND. (Fi) Teho. 6/7: 284-290, 298. 1962. 20 T98
English summary, pp. 303.

An illustrated report was given of the use and need of surface leveling and grading or cropland in Finland.

3251. Valeanu, L., and Poenaru, I. PRUNING AND TRELLISING THE GRAPE VINE ON BENCH TERRACED SLOPES. (Rum) Gradina, Via si Livada. 12(1): 34-40. Jan. 1963. 80 G75

3252. Van Der Merwe, A. J. PROTECT WATERWAYS WITH GRASS. Farming So. Africa. 40(7): 39, 41, 43. Oct. 1964. 24 So842

A report was given on the use and need of grass waterways in South Africa.

3253. Vishnevskii, V. P. TERRACING RAVINE SLOPES FOR ORCHARDS. (Rus) Vest. Sel'skokhoz. Nauki (Moscow) 11: 43-44. Nov. 1963. 20 V633

3254. Waffenschmidt, D. IMPROVEMENT OF KARST LAND IN ISTRIA. (Ge) Wasser u. Boden. 13(11): 379-380. Nov. 1961. 56.8 W28

3255. Walker, P., and Lillard, J. H. LAND FORMING—AN ACCEPTED DRAINAGE PRACTICE. Agr. Engin. 41(1): 24-27. Jan. 1960. 58.8 Ag83

A study was reported of the engineering practices and costs of the various operations required for land forming on Elkton very fine sandy loam soil in Virginia.

3256. Walker, P., and Lillard, J. H. LAND FORMING IN THE SOUTHEAST. J. Soil and Water Conserv. 16(4): 166-169. July/Aug. 1961. 56.8 J822

A report was given on the use of landforming in the southeast area of the United States.

3257. Wallbrink, J. C. GRADING, THE KEY TO DRAINAGE FOR GOULBURN VALLEY ORCHARDS. Victorian Hort. Digest. 8(1): 7-8. Autumn 1964. 80 V662

A report was given on the need and use of grading and small ditches for drainage of irrigated orchards in Australia.

3258. Watson, J. E. A PRACTICAL GUIDE TO BUILDING CONTOUR BANKS WITH A ROAD GRADER. Western Australia Dept. Agr. J. (ser. 4)4(9): 543-547. Sept. 1963. 23 W52J

A guide was given on the construction of contour banks (terraces) with a road grader in Australia.

3259. Western Australia Department of Agriculture. Soils Division. A PRACTICAL APPROACH TO FLOODING AND SALT PROBLEMS IN THE WHEATBELT. Western Australia Dept. Agr. J. (ser. 4) 3(10): 773-778. map. Oct. 1962. 23 W52J

A report was given on the use of contour mounds (terraces) to reduce flooding and salt problem of the lowlands in Australia.

3260. Western Crops and Farms Management. LAND FORMING: LEVEL IS NOT ALWAYS BEST! Western Crop and Farm Mangt. 9(1): 36-38. Jan. 1960. 281.8 F2225

A report was given on the use of land forming in the United States for surface drainage.

3261. Wilkie, D. R. SOIL CONSERVATION BY CONTOUR METHODS. New Zealand Soil Conserv. and Rivers Control Council. B. 10, rev., 32 pp. 1955. 56.9 N49

A report was given on the use, construction, and maintenance of contour and terraces in New Zealand.

3262. Willrich, T. L. MODERN TERRACE DESIGNS BOOST PROGRESS IN IOWA. Agr. Leaders' Digest. 37(6): 10, 16. June 1956. 275.28 Am3

A report was given of the use of modern terraces in Iowa. Diversion terraces, basin terraces, and the use of short terrace sections and natural waterways were discussed.

3263. Wiltshire, G. R. THE USE OF BANKS IN SOIL CONSERVATION. N. S. Wales Soil Conserv. Serv. J. 12: 99-107. July 1956. 56.9 N472

A report was given on the need and use of diversion banks (terraces) level banks (terraces), and graded banks (terraces) in Australia. The construction and use of grass waterways were described.

3264. Wimberly, J. LAND FORMING FOR COTTON PRODUCTION. In Louisiana. Agricultural Experiment Station. Louisiana cotton producers hdbk, pp. 8-10. 1963. 72 L932

A report was given on the use of land forming for surface drainage of cotton fields in Louisiana.

3265. Wittmus, H. D. CONSERVATION BENCHING: A NEW CONCEPT IN LAND SHAPING. Nebr. Expt. Sta. Q. 10(2): 8-9. Summer 1963. 100 N27N

A report was given on the use of conservation benching for land shaping in Nebraska.

3266. Woodruff, C. B., Jr. "BEDDED" LANDS SOLVE NEW YORKER'S HAY PROBLEM. Soil Conserv. 29(3): 58-59. 1963. 1.6 So3S

A report was use of the "beds" with water interceptor ditches for producing up to 5 tons an acre of bromegrass, alfalfa, and birdsfoot trefoil hay in New York.

3267. Zaslavskii, M. N. ALTERNATE STRIP SYSTEM IN RECLAMATION OF SLOPES FOR FEED PRODUCTION. (Rus) Zhivotnovodstvo. 8: 24-29. Aug. 1955. 49 Z6

3268. Zaslavskii, M. N. TERRACING WITH ASSISTANCE OF COMMON PLOWS AS ECONOMIC METHOD OF SLOPE RECLAMATION. (Rus) Vinodel. i Vinograd. SSSR. 21(2): 28-31. 1961. 95.8 V77

3269. Ziemnicki, S. PLOUGHED-ON TERRACES AS A MEASURE AGAINST WATER EROSION OF SOILS. Rocz. Gleboznawcze. 14(sup.): 325-343. 1964. 56.8 R592

A report was given on the use of plow terraces for water erosion of soils in Poland.

3270. Zingg, A. W., and Hauser, V. L. BENCH TERRACES PUT WATER TO WORK. Crops and Soils. 11(5): 16, 30. 1959. 6 W55

For conservation benching, wide, level contour benches are built at intervals on the slope to hold runoff from a strip of land above. This contributing area, or watershed is approximately twice the size of the leveled bench below it.

A terrace ridge (lip) is constructed on the lower edge of the bench to hold the runoff water. The ends of the leveled terraces are also blocked, so that a 6-inch depth of water will accumulate on the bench before excess runoff is drained away. A terrace outlet to safely dispose of large amounts of runoff is provided, and it is similar to other types of sod waterways.

3271. Zingg, A. W., and Hauser, V. L. TERRACE BENCHING TO SAVE POTENTIAL RUNOFF FOR SEMIARID LAND. Agron. J. 51(5): 289-292. May 1959. 4 Am34P

A report was given of the use of the Zingg conservation bench terrace to save potential runoff for semiarid land. Adequate outlet capacity and provision for drainage are essential design features.

3272. Zsoldos, L. PREPARATION OF FRUIT SOILS WITH TERRACING. (Hu) Kerteszeit es Szoleszeti Foisk. Evkon. 2(1): 57-66. Ref. 1963. 80 B85
German summary.

SEE ALSO--36, 40, 46, 65, 127, 338, 514, 530, 724, 730, 731, 1009, 1052, 1203, 1293, 1348, 1369, 1381, 1425, 1607, 1611, 1613-1615, 1618, 1632, 1640, 1641, 1644, 1648, 1658, 1660, 1662, 1663, 1679, 1681, 1682, 1685, 1697, 1704, 1713, 1725, 1732, 1738, 1758, 1777, 1778, 1783, 1788b, 1790, 1805, 1806, 1809, 1827, 1838, 1848, 1860, 1879, 1880, 1891, 1892, 1901, 1913, 1926, 1935, 1952, 1966, 2009, 2010, 2013, 2014, 2040, 2044, 2051, 2060, 2061, 2062, 2088-2091, 2093, 2097, 2103, 2122-2124, 2140, 2153, 2170, 2175, 2187, 2194, 2196, 2201, 2208, 2214, 2218, 2219, 2253, 2254, 2258, 2260, 2264-2266, 2278, 2307, 2323, 2327-2331, 2333, 2339, 2356, 2378, 2383-2385, 2420, 2452, 2453, 2470, 2475, 2478, 2479, 2496, 2516, 2540, 2543, 2548, 2577, 2586, 2608, 2623, 2626, 2633, 2665, 2678, 2687-2689, 2705, 2713, 2759, 2765, 2766, 2773, 2777, 2778, 2784, 2795, 2813, 2814, 2818, 2855, 2881, 2924, 2938, 2977, 3307, 3318, 3323, 3349, 3383, 3431, 3465, 3616, 3634, 3635, 3649, 3655, 3666, 3672, 3685, 3689, 3690, 3698, 3706, 3709, 3725, 3728, 3742, 3743, 3746, 3749, 3761, 3766, 3770, 3777, 3783, 3788, 3791, 3799, 3822, 3836, 3858, 3867, 3868, 3870, 3886, 3899, 3929, 3938, 3940-3942, 3949, 3953, 3957, 3971, 3984, 3991, 4004, 4027, 4044, 4056, 4060, 4061, 4076, 4078, 4102, 4127, 4136, 4144, 4175, 4176-4178, 4195, 4208, 4211-4213, 4219, 4223, 4248, 4250, 4254, 4264, 4287, 4291, 4296, 4311, 4323, 4324, 4370, 4385, 4391, 4399, 4409, 4410, 4413, 4414, 4415, 4438, 4444, 4453, 4463, 4464, 4497, 4507, 4602, 4613, 4697, 4722, 4746, 4784, 4785, 5028, 5030-5032, 5034, 5036, 5046, 5065, 5070.

Subsurface Drainage

3273. Albino Figueroa, V. DECLIVITY DITCHES AND PROTECTED DRAINAGE. (Sp) Rev. del Cafe. 14(9): 17-18, 20. June 1959. 8 R3295

3274. Alekand, K. THE EFFECT OF THE FILTER LAYER ON THE EFFECTIVENESS OF DRAINAGE. (Es) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 17: 144-152. 1960. 106 Ex83
German summary.

3275. Andriyauskaite, E. TILE DRAINAGE IN LITHUANIA. (Rus) Gidrotekh. i Melior. 1961(7): 40-43. July 1961. 290.8 G362

3276. Anonymous. SUGAR CANE IN NEW SOUTH WALES. III. TILLAGE AND DRAINAGE. World Crops. 11(7): 256-258. July 1959. 281.8 W892

A report was given on the tillage and drainage requirements for sugarcane in New South Wales in Australia.

3277. Antonov, V. I. SUB-SURFACE DRAINAGE AND IMPROVEMENT OF LANDS. (Rus) Moskva, Izd-vo selkhoz lit-ry, zhurnalov i plakatov, 103 pp. 1963. 54 An8

3278. Antonov, V. I., and Bogomolov, I. V. GROOVED WOODEN CONDUITS FOR DRAINAGE OF THE MESHCHERA LOWLANDS. (Rus) Gidrotekh. i Melior. 1960(7): 47-52. July 1960. 290.8 G362

3279. Antonov, V. I., and Golovko, D. SUBSURFACE DRAINAGE OF LANDS AND THEIR RECLAMATION. (Rus) Moskva, Izdatel'stvo Selskokhozyaistvennoi Literatury, Zhurnalov I Plakatov, 104 pp. Ref. 1963. 54 An8

3280. Antonov, V. I., and Shreider, V. A. AN EXPERIMENT IN THE USE OF PLASTIC DRAINAGE PIPES. (Rus) Gidrotekh. i Melior. 1961(8): 29-37. Aug. 1961. 290.8 G362

3281. Aronovici, V. S., and Donnan, W. W. AN ELECTRICAL GRADE-ALIGNMENT PROBE; MEANS FOR ELIMINATING EXPENSIVE EXPLORATORY EXCAVATION. Agr. Engin. 42(5): 251-252. May 1961. 58.8 Ag83

A simple instrument was described for the observation of mole drain alignment. The instrument can be used for both unlined and plastic lined mole drains.

3282. Aslyng, H. C. PREVENTION OF OCHER FORMATION IN DRAINAGE PIPES. (Da) Danske Hedeselsk. Hedeselsk. Tidsskr. 77: 10-19. Jan. 15, 1956. 11 H35

3283. Baathe, A. COVERED DITCHES. (Sw) Lantbrtidskr. f. Jamtland och Harjedalen. 7(1): 6-7; (2): 4-6; (4): 4-6. 1954. 11 L293

3284. Baathe, A. PIPE DRAINAGE. (Sw) Lantbrtidskr. f. Jamtland och Harjedalen. 9(2): 4-6. 1956. 11 L293

3285. Baathe, A. PIPE DRAINAGE. (Sw) Lantbrtidskr. f. Jamtland och Harjedalen. 10(1): 4-6. 1957. 11 L293

3286. Baathe, A. PIPE DRAINAGE. (Sw) Lantbrtidskr. f. Jamtland och Harjedalen. 10(2): 11-13. 1957. 11 L293

3287. Bakker, A. C. VERTICAL MULCHING. Victorian Hort. Digest. 4(2): 5-7. Summer 1960. 80 V662

A report was given on the use of vertical mulching of straw for clay soils for peach trees in Australia.

3288. Bakker, A. C. TILE DRAINAGE FOR GOULBURN VALLEY ORCHARDS. Victorian Hort. Digest. 8(1): 26-27. Autumn 1964. 80 V662

A report was given on the need and use of tile drainage in Australia on sandy soils with a clay layer at about 6 feet.

3289. Banting, A. E. CHECK YOUR UNDERDRAIN OUTLET. MacDonald Farm J. 16: 4-5. Sept. 1955. 101 M144

A report was given on the use of and checking of good drainage outlets for tile drainage systems in Canada.

3290. Barry, G. S. LAND DRAINAGE AND NEW LEGISLATION. Scot. Milk Mktg. Bd. News B. 5(10): 17-23. Oct. 1958. 280.39 Sco3N

The purpose and methods of land drainage were described. The effect of new legislation (1958) in Scotland on land drainage was discussed.

3291. Beauchamp, K. H. TILE DRAINAGE—ITS INSTALLATION AND UPKEEP. U.S. Dept. Agr. Ybk. Agr. 1955: 508-520. 1955. 1 Ag84Y

A report was given on the installation and upkeep of tile drainage. A well designed and constructed tile system will not require extensive maintenance, but the maintenance that is required is extremely important. One broken tile will stop up an entire line. Many tile systems and even parts of farms have been ruined because of neglect of the outlet.

3292. Berggren, B. COVERED DRAINAGE DITCHES ON ARABLE LAND. (Sw) Lantbrtidskr. f. Stockholms Lan och Stad. 8(4): 11-15. 1958. 12 L29

3293. Bergland, G. MOLE DRAINAGE. I. (Sw) Grundforbattring. 9(3): 154-176. 1956. 54.8 G92 English summary.

A report was given on mole drainage and its value under Swedish conditions.

3294. Bergland, G. MOLE DRAINAGE. II. (Sw) Grundforbattring. 9(4): 227-258. 1956. 54.8 G92 English summary.

A report was continued on the value of mole drainage under Swedish conditions.

3295. Bergman, I. I., and Uiska, I. TILE DRAINAGE OF TURF-CARBONACEOUS SOILS. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POXHV, 1955. Trudy, pp. 49-61. Minsk, 1956. 54.9 K83

3296. Beskov, I. K. MOLE DRAINAGE OF SOILS IN THE CENTRAL CHERNOZEM AREA. (Rus) Vest. Sel'skokhoz. Nauki. 2(5): 96-102. Ref. May 1957. 20 V633
English summary.

Mole drainage was recommended as a new and highly efficient method of building up soil fertility for reclamation and improved aeration of soils with surplus moisture and for collecting and conserving rain and thawing water. The installation and cost of mole drains were described. Mole drains provided a better water supply to plants and better water intake of soils.

3297. Bishop, A. A. RECLAMATION OF POORLY DRAINED SOILS. Farm and Home Sci. [Utah Sta.] 23(1): 18-19, 30-31. Mar. 1962. 100 Ut1F

A report was given on the reclamation of poorly drained soils in Utah by plastic lined mole drains and unlined mole drains.

3298. Black, J. D. F. ORCHARD DRAINAGE. Fruit World and Mkt. Grower. 63(7): 35. July 1962. 80 F948

A report was given on the use of subsurface drainage for orchards in Australia. The use was discussed of mole drainage, brush drainage, and pipe drainage.

3299. Blair, J. F. SELF-HELP BUILDS LOW-COST DRAINAGE SYSTEM. Land Impr. 5(6): 8-9. June 1958. 282.8 L224

A report was given of the progress of the drainage district organized by farmers in Utah. Concrete drainage tile was used to replace the original open ditches used in the area.

3300. Blesvik, K. OPEN OR COVERED DITCHES ON ARABLE LAND. (No) Norsk Landbr. 24: 533, 538. Nov. 21, 1958. 11 N8122

3301. Blesvik, K. COUPLING OF INTERCEPTION AND PIPE DITCHES. (No) Norsk Landbr. 24: 706-707, 726. Nov. 18, 1960. 11 N8122

3302. Boer, P. G. De. BRINGING EASTERN FLEVOLAND UNDER CULTIVATION. (Du) Netherlands Dir. van de Tuinbouw. Meded. 19: 487-500. Aug./Sept. 1956. 86 N384
English summary.

A discussion was given of the government plan for the proposed reclamation and temporary cultivation of land in Eastern Flevoland in the Netherlands.

3303. Bornstein, J. IMPROVED FARM DRAINAGE—A CONTINUING CONSERVATION GOAL. Co-op Life (Vt. Elect. Coop., Inc.) 24(2): 10-11. 1962.

A report was given on a drainage research project in Vermont Cabot loam soil using bituminized pipe and/or diversions.

3304. Borshchov, T. S., and Klimko, A. I. MOLE DRAINAGE WITH PLOWING AT THE SAME TIME. (Rus) Gidrotekh. i Melior. 11(2): 21-27. Feb. 1959. 290.8 G362

3305. Boulle, P. F. COVERED DRAINAS. So. African Sugar Technol. Assoc. Proc. 35: 128-129. 1961. 65.9 So83

A report was given on the use of bamboo pipes for covered drainage in South Africa.

3306. Bouwer, H. TILE DRAINAGE OF SLOPING FIELDS. Agr. Engin. 36: 400-403. 1955. 58.8 Ag83

Transverse and longitudinal tile-drainage systems in uniform soils were compared with regard to their draining capacities.

The results showed that for both comparable longitudinal and transverse tile-drainage systems had the same draining capacities. On the basis of this result, it was recommended that time lines (laterals) be installed at an angle between 10 and 30° with the contour lines.

3307. Bowler, D. G. FARM DRAINAGE; SOME IMPORTANT DEVELOPMENTS TOGETHER WITH RECOMMENDATIONS FOR THE MORE EFFICIENT MANAGEMENT OF DRAINED LAND. Massey Agr. Col. Sheepfarming Annu. 1956: 241-247. 1956. 45.9 M38S

Farm drainage recommendations and research results were given for New Zealand. Open drains, closed drains, and surface drains were discussed.

3308. Bowler, D. G. MOLE DRAINAGE COUPLED TO TILE SYSTEM WHERE SOIL IS SUITABLE. New Zealand Meat Prod. 4(10): 31, 33. July 1960. 50.8 N48

A report was given on the use of mole drains plus tile drainage in New Zealand.

3309. Bowler, D. G. FARM MANAGEMENT ON WET SOILS. Ruakura Farmers' Conf. Week. Proc. 1961: 217-224. 49.9 R82

A report and discussion were given on farm management of wet soils in New Zealand after the installation of field drains.

3310. Brooks, D. R. HAND LAYING CONCRETE DRAIN TILE IN OPEN DITCHES. Irrig. Engin. and Maintenance. 10(11): 8-9. Nov. 1960. 55.8 Ir722

A report was given of the economics of placing concrete drain tile by hand in difficult soils in California. The ditch was first constructed by a dragline.

3311. Brownscombe, R. H. FIELD EVALUATION OF TILE DRAINS LAID WITH ORGANIC BLINDING MATERIALS. Trans. ASAE 5(1): 61-63, 67. 1962. 290.9 Am32T

A field evaluation was given on tile drains laid with organic (straw and woodchips) blinding materials in Washington. Clay tile was used on two of the farms and cement tile on the other six farms.

3312. Busch, C. D. AN INVESTIGATION OF MOLE DRAIN DETERIORATION AND OF A METHOD OF EXTANDING DRAIN LIFE. Diss. Abs. 20(12): 4608-4609. June 1960. 241.8 M58

The advantages and disadvantages of mole drainage in New York were discussed. An investigation was reported on the use of plastic lined mole drains to prolong drain life.

3313. Busch, C. D., and Edminster, T. W. LOW COST SUBSURFACE DRAINAGE INSTALLATION. Building Res. Inst. Annu. Mtg., Apr. 21-23, 1958, Washington, D.C. 5 pp. 1958.

A low cost subsurface drainage installation of plastic lined mole drains was described and illustrated.

3314. Busch, C. D., and Edminster, T. W. LOW-COST SUBSURFACE DRAINAGE. Rubber and Plastics Age. 39(9): 766-767. Sept. 1958. 305.8 R824

A discussion was given on the research on the use and construction of plastic lined mole drains for low-cost subsurface drainage.

3315. Busch, C. D., and Edminster, T. W. MODERNIZING DRAINAGE METHODS. Australia Irrig. and Pasture Impr. 4(5): 35-36. Apr. 1959. 55.8 Au7

A preliminary report was given on research of plastic underdrains to stabilize mole drains in the United States.

3316. Cahill, R. G. ORCHARD DRAINAGE. Western Australia Dept. Agr. J. (ser. 4)2(6): 529-532. June 1961. 23 W52J

A report was given on the use of tile drainage for orchards in Australia.

3317. Caudwell, R. LAND DRAINAGE. Farmers' Club. J. 2: 140-152. 1960. 10 L84

A lecture and discussion were given on land drainage in England.

3318. Cavender, N. TERRACES AREN'T WORTH A DAM. Farm Q. 19(2): 48-51, 109-110, 112, 115-116, 118. Summer 1964. 6 F22995

A report was given on the use of the Hydrosol Intrasitive Land Engineering method (HILE) in Illinois in place of terraces.

3319. Choate, R. E. UNDERGROUND DRAINAGE OF FLATWOOD SOILS. Fla. Res. Rpt. 8(4): 11. 1963.

In tests in the flatwood soils in Florida, a 6 inch band of sawdust around the tile joints was the most effective filter for tile drainage. The order of preference for the other materials tested were fiberglass, gravel, and asphalt felt.

3320. Chukreev, V. K. MOLE PLOWING OF SOILS AS A MEASURE FOR REGULATING THEIR AIR-MOISTURE REGIME. (Rus) Vsesoiuzn. Akad. Sel'skokhoz. Nauk. im V. I. Lenina. Dok. 22(8): 44-48. 1957. 20 Ak1

3321. Dancau, B. IMPROVEMENT OF WET MEADOWS WITH HELP OF MOLE DRAINAGE. (Ge) Bayer. Landwirt. Jahrb. 41(1): 75-81. 1964. 18 L24

3322. Dijkstra, R. J. ADVANTAGES AND DISADVANTAGES OF PLASTIC AND TILE DRAINS; A LITERATURE REPORT. (Du) Landbouwdocumentatie. 20(19): 659-660, 662-663, 665-666, 668-669. Ref. May 9, 1964. 241 N38

3323. Diseker, E. G., and van Schilfgaarde, J. FIELD EXPERIMENTS WITH TILE AND DITCH DRAINAGE. N.C. Agr. Expt. Sta. Tech. B. 133, 25 pp. July 1958. 100 N81

A detailed study was reported on field experiments with tile and ditch drainage in North Carolina.

3324. Donnan, W. W., and Aronovici, V. S. PLASTIC-LINED MOLE DRAINS FOR IRRIGATED AREAS. J. Irrig. and Drain. Div., ASCE 88(IR 4, pt. 1): 39-42. Dec. 1962. 290.9 Am3Ps

Field tests were reported on the use of plastic-lined mole drains at seven locations in irrigated areas of Western United States. They failed completely in sandy soils and were moderately successful when installed in clay or clay-loam soils.

3325. Dylla, A. S., and Rollins, M. B. EXPERIMENTAL PLASTIC-LINED MOLE DRAINS SHOW PROMISE BUT MORE RESEARCH NECESSARY. Nev. Ranch and Home Rev. 2(5): 10-11. Fall/Winter 1962/63. 60.18 Sci 2

A preliminary report was given on the use and installation of plastic-lined mole drains in Nevada.

3326. Dylla, A. S., Rollins, M. B., and Myers, V. I. EXPERIMENTAL PLASTIC DRAINS IN NEVADA. Nev. Agr. Expt. Sta. B. 228, 13 pp. Ref. June 1963. 100 N41S

Results were given of experimental plastic lined mole drains installed at 30 inch depths on three sites on Nevada. It was concluded that the plastic lined mole drains were unsuited for alleviating Nevada drainage problems until a liner with greater resistance to collapse could be developed.

3327. Ede, A. N. INNOVATIONS IN LAND DRAINAGE METHODS. Inst. Brit. Agr. Engin. J. 14(1): 8-23. Ref. Jan. 1958. 58.9 In7

A report was given on land drainage methods in different countries. The use in England of stabilized mole drains by the vibration system and by concrete was emphasized.

3328. Ede, A. N. NEW METHODS OF FIELD DRAINAGE. Great Britian Min. Agr. Fisheries and Food Agr. 70(2): 82-86. Feb. 1963. 10 G79J

A report was given on the use of plastic tube drainage installed by a mole plow in England.

3329. Efendiev, N. T. STRUCTURE OF COSTS OF HORIZONTAL PIPE DRAINAGE. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 183-192. Ref. 1962. 20 M857

3330. Egberts, H. DRAINING SYSTEMS IN THE BOSKOOP AREA. (Du) Netherlands Dir. van de Tuinbouw. Meded. 21(4): 203-209. Apr. 1958. 86 N384
English summary.

A report was given on the installation, use, and advantages of a closed drainage system of a tree nursery in the Netherlands where about 50 cm. of topsoil has been added to the peat area.

3331. El Madany, M. THE ROLE OF TILE DRAINAGE IN LAND DEVELOPMENT IN THE UNITED ARAB REPUBLIC. Near East-S. Afr. Irrig. Pract. Seminar. [Proc.] 5: 305-315. 1964. 173.2 In8Reg

A report was given on the need, use, and design of tile drainage in the United Arab Republic.

3332. Erlandsson, I. A STUDY TRIP IN THE KLAR RIVER VALLEY. (Sw) Grundforbattring. 14(4): 241-252. 1961. 54.8 G92

3333. Evans, N. A., Pugh, W. J., and Davis, S. DRAINAGE. Colo. Agr. Expt. Sta. Colo. Prog. Rpt. 112, 2 pp. Nov. 1963. 100 C71C

A progress rport was given on the installation and use of plastic lined mole drains in Colorado on Billings clay loam soils.

3334. Faithful, W. DEVELOPMENT OF SOUTHLAND PEAT SOILS. New Zealand J. Agr. 98(2): 113, 115, 117-118. Feb. 16, 1959. 23 N49J

A report was given on the development being used on peat soils in New Zealand.
The peat areas are first drained by open ditches and then by mole drainage after the pastures have become established. There has been a great increase in the carrying capacities of the pastures with the mole drainage.

3335. Feichtinger, F. MOLE DRAINAGE—A FORM OF SOIL MELIORATION. (Ge) Forderungsdienst. 8(10): 306-309. Oct. 1960. 19 F75

3336. Feichtinger, F., and Schleifer, H. MOLE DRAIN RESEARCH. (Ge) Oesterr. Wasserwirt. 14(6): 117-125. June 1962. 55.8 Oe8

3337. Feigin, M. P. USE OF CONCRETE DRAINAGE PIPES FOR AGGRESSIVE UNDERGROUND WATERS IN MUGAN AREA. (Rus) Gidrotekh. i Melior. 10: 30-35. Oct. 1964. 290.8 G362

3338. Feodoroff, A. WHERE DO WE STAND IN MOLE DRAINING? (Fr) Agr. [Paris] 24(234): 161-165. Ref. May 1961. 14 Ag823

3339. Feodoroff, A. WHERE DO WE STAND IN MOLE DRAINAGE? (Fr) Agr. [Paris] 24(235): 183. June 1961. 14 Ag823

3340. Ferguson, F. L. DRAINAGE ACTS AND ASSISTANCE. Ontario Dept. C. 240, 6 pp. Jan. 1955. 7 On8Ci

A report was given on the Drainage Acts in Canada and their type of assistance to the farmer to help him with his drainage problem.
The three principal acts to make provision for finicial assistance are: (1) The Tile Drainage Act, which permits a farmer to borrow money to do tile drainage work on his own farm; (2) the Provincial Aid to Drainage Act of 1954, which permits a township council to apply for a grant to help finance work under the Municipal Act; and (3) the Municipal Drainage Aid Act, which permits a township council to pay for the drainage work, and spread the cost over a period of years to the farmers concerned.

3341. Ferguson, F. L., and Irwin, R. W. DRAINAGE ACTS AND ASSISTANCE. Ontario Dept. Agr. P. 240, 8 pp. Aug. 1960. 7 On8P

A brief summary was given of the necessary procedures for a Canadian farmer to follow when he wishes assistance for help in drainage provided under the various drainage acts.

3342. Ford, H. W., and Spencer, W. F. COMBATTING IRON OXIDE DEPOSITS IN DRAIN LINES. Citrus Indus. 43(11): 5-7, 11. Ref. Nov. 1962. 80 C49

A sludge-like red deposit in several tile lines in Florida, caused principally by various iron bacteria, can be controlled by certain alkaline filter materials. Slag gravel was found most effective as a means of precipitating ferrous iron before it entered the tile line. Copper, either as wire in the pipe or copper sulphate in the backfill, did not appear to be an effective, economical, long-term deterrent to the sludge problem in Florida.

3343. Ford, H. W., and Spencer, W. F. COMBATTING IRON OXIDE DEPOSITS IN DRAIN LINES. Fla. State Hort. Soc. Proc. 75: 27-32. Ref. 1962, pub. 1963. 81 F66

A report was given on the use of slag gravel as a means of precipitating ferrous iron before it entered the tile lines to avoid the sludge-like red deposits found in several tile lines in Florida due to iron bacteria.

3344. Fouss, J. L., and Donnan, W. W. PLASTIC-LINED MOLE DRAINS; PROMISING ANSWER TO LOW-COST SUBSURFACE DRAINAGE. Agr. Engin. 43(9): 512-515. Ref. Sept. 1962. 58.8 Ag83

Plastic-lined mole drains for low cost subsurface drainage and their installation equipment were described and illustrated. Field and laboratory studies were reported on the use of these plastic-lined mole drains.

3345. Fouss, J. L., and Fausey, N. R. EXPERIMENTAL PLASTIC DRAINS. Ohio Farm and Home Res. 49(4): 54-55. July/Aug. 1964. 100 Oh3S

A report was given on the installations and use of experimental plastic mole drains in Ohio.

3346. Fouss, J. L., and Schwab, G. O. RESEARCH ON PLASTIC-LINED MOLE DRAINS IN THE UNITED STATES. Internatl. Cong. Agr. Engin. 6(II): 150-158. 1964.

A report was given on the research in the United States on plastic lined mole drains and the equipment for installing the drains.

3347. Gallwitz, K. EXPERIMENTS WITH PLASTIC DRAINAGE PIPES. (Ge) Deut. Agrartech. 14(1): 10-12. Jan. 1964. 58.8 D482

3348. Gillhoff, J. IS THE INSTALLATION OF OUR FIELD DRAINS AND BROOKS APPROPRIATE? (Ge) Deut. Gartbau. 4(4): 102-104. Apr. 1957. 80 G1948

3349. Gordon, J. IN THE CANEFIELD—HOW SHOULD LAND DRAINAGE BE DONE? So. African Sugar J. 43(3): 227, 229, 257. Mar. 1959. 65.8 So8

A report was given on the need of land drainage in sugarcane fields in South Africa. Open drains, closed drains, and mole drains were discussed.

3350. Gorinskii, V. N. PIPE DRAINAGE IN FOREIGN PRACTICE. (Rus) Gidrotekh. i Melior. 1961(8): 53-61. Ref. Aug. 1961. 290.8 G362

3351. Great Britian Ministry of Agriculture, Fisheries and Food. MOLE DRAINAGE FOR HEAVY LAND. Great Britian Min. Agr. Fisheries and Food, Growmore L. 44, rev., 6 pp. folder. Jan. 1960. 10 G79Gr

Mole drainage for heavy land in Great Britian was described and illustrated.

3352. Grebing, G. FALL GRAIN REQUIRES COVERED DITCHES. (Sw) Tidskr. f. Hushsallsk. och Skogsvardsstyr. i Gavleborgs Lan. 31: 77-78. 1955. 11 T434

3353. Hakansson, A. DRAINAGE EXPERIMENTS WITH DIFFERENT TILE SPACINGS; AN EVALUATION OF METHODS USED ON THE BASIS OF DATA RECEIVED. (Sw) Grundforbattring. 14(spec. no. 4), 98 pp. Ref. 1961. 54.8 G92
English summary.

Studies were reported in Sweden on drainage experiments with different tile spacings. The results of two experimental designs were discussed.

3354. Hallgren, G. DAMMING UP OF UNDERGROUND WATER BY MEANS OF OPEN OR COVERED CONDUITS. (Sw) Beten-Vallar-Mossar. 8: 21-23. Mar. 1956. 11 B46

3355. Hallgren, G., and Ostholm, C. O. RUST PRECIPITATES IN DRAINAGE PIPES. (Sw) Grundforbattring. 10(2): 87-101. Ref. 1957. 54.8 G92
English summary, pp. 154.

Investigations were reported on iron precipitates in drain pipes in Sweden. Different methods of preventing such precipitates were discussed.

3356. Hannigan, M. A. DRAINING OF THE VINEYARD. (Sum.) Queensland Fruit and Veg. News. 9: 413. Mar. 29, 1956. 280.38 Q3

A report was given on the need and use of open drains, tile drains, and mole drains for vineyards in Australia.

3357. Hansen, R. L. FILTER MATERIALS FOR SUBSURFACE DRAINS. Vt. Agr. Expt. Sta. Misc. P. 25, 15 pp. June 1963. 100 V59M

A report was given on the comparison of gravel filters and fiber glass filters for tile drainage and perforated pipe drainage systems in Vermont.

3358. Harris, K. A. SYSTEMS AND COSTS OF DEVELOPING POORLY DRAINED SOILS. Citrus Indus. 45(3): 5-6, 8-11. Mar. 1964. 80 C49

A discussion was given of the requirements and costs of drainage for citrus in Florida.

3359. Harvey, N. DITCHES, DYKES, AND DEEP-DRAINAGE. Young Farmers' Club Booklet 29, 48 pp. Ref. 1956. 10 Y82

The story of land drainage in the past, present, and predicted for the future was given for the Young Farmers' Club members in England.

3360. Hauser, V. L., and Taylor, H. M. EVALUATION OF DEEP-TILLAGE TREATMENTS ON A SLOWLY PERMEABLE SOIL. Trans. ASAE 7(2): 134-136, 141. Ref. 1964. 290.9 Am32T

A study was reported on the effect of deep tillage treatments on water-intake rate, water movement in the soil, crop yield, and duration of effects on Pullman silty clay loam soil in Texas. The tillage treatments studied were: Disc plowing 24 inches deep; vertical mulching 24 inches deep on 80-inch centers; chiseling 24 inches deep on 80-inch centers; and a check treatment not tilled below 4 inches. Disc plowing and vertical mulching increased the water intake rate 1.9 and 1.5 times, respectively, the water intake for the check. Chiseling was relatively ineffective after one irrigation.

Sorghum residue placed in the vertical mulch slots were still intact after 3 years in the soil.

3361. Heese, K., and Holjewilken, H. NEW MOLE DRAINAGE METHODS. (Ge) Deut. Agrartech. 12(2): 84-89. Feb. 1962. 58.8 D482

3362. Henin, S. SUBSOIL AND MOLE DRAINAGE. (Fr) B. des Cent. d'Etudes Tech. Agr. 61(339), 6 pp. Aug./Sept. 1959. 14 B878

3363. Henin, S., and Feodoroff, A. MOLE DRAINING AND SUBSOILING. (Fr) France Inst. Natl. de la Rech. Agron. Ann. Ser. A, Ann. Agron. 9(5): 567-591. Sept./Oct. 1958. 14 F8499
English summary.

A report was given on the use of mole draining and subsoiling in France.

Mole drainage gave good results when done under favorable conditions. The structural stability of the subsoil was an essential requirement for success. Laboratory determination of the structural stability of the subsoil should be made before mole draining.

3364. Hintikka, V. COST OF COVERED DITCHES. (Sw) Tidskr. f. Lantman och Andelsfolk. 20: 477. Oct. 30, 1962. 20 T43

3365. Hintikka, V. OBJECTIVES AND POSSIBILITIES FOR COVERED DRAINAGE DITCHES. (Sw) Tidskr. f. Lantman och Andelsfolk. 21: 512-513. Nov. 15, 1962. 20 T43

3366. Holjewilken, H., and Heese, K. A TRUE MOLE DRAINAGE PROCEDURE. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 3(1): 37-39. Jan. 1962. 18 W763

3367. Hore, F. R., Irwin, R. W., and Ayers, H. D. TILE DRAINAGE IN ONTARIO. Agr. Inst. Rev. 16(5): 24-26. Sept./Oct. 1961. 7 Ag8

A report was given on tile drainage problems, the progress of drainage to date, and research activities under way in Ontario, Canada.

3368. Hosoyamada, K. ON VARIOUS PROTECTIVE FILTERS. I. (Ja) Saga U. Agr. B. 19: 63-75. Oct. 1964. 107.6 Sa13
English summary.

A report was given on the use of fiber glass and sand gravel filters for drains in Japan.

3369. Houston, C. E. DRAINAGE OF IRRIGATED LAND; IT'S EXPENSIVE BUT CAN PAY OFF HANDSOMELY. III. World Farming. 5(10): 46-48, 50. (Cont.) Oct. 1963. 30.08 W89

A report was given on the use of tile for draining irrigated land in California.

3370. Hummon, G. A. DRAINAGE AND AGRICULTURAL PRODUCTION. Indian Dairyman. 10(11): 281-282. No. 1958. 44.8 In282

The economics of drainage for agricultural production in India were stressed.

Lack of adequate outlets was considered the major obstacle at present. The use of both open and closed drains was discussed.

3371. Hunt, D. M. ORCHARD DRAINAGE. Tasmanian J. Agr. 28(3): 233-236. Aug. 1957. 23 T182T

A discussion was given on the value of orchard drainage for Tasmania. Tile drainage was recommended as the most permanent and the least expensive to maintain when it was properly applied. Mole drainage was recommended on a trial basis because of its favorable overseas results.

3372. Hunt, D. M. ORCHARD DRAINING IS ESSENTIAL. Fruit World and Mkt. Grower. 58(10): 31, 33. Oct. 10, 1957. 80 F948

A report was given on the need of orchard draining in Tasmania along with a discussion of the following kinds of drainage: Open ditches; tile drainage; mole drainage; and interception drainage around seeps and spews.

3373. Ignatenok, F. V. CLOSED DRAINAGE IN ORCHARDS AND PARKS. (Rus) Sad i Ogorod. 10: 56-58. Oct. 1956. 80 Sa13

3374. Ignatenok, F. V. AVOID ERRORS IN LAYING DRAINS. (Rus) Sel'sk. Khoz. Belorussii. 1962(1): 35. Jan. 1962. 20 Se496Ar

3375. Irwin, R. W. FARM DRAINAGE ASSISTANCE. Ontario Dept. Agr. P. 4, rev., 6 pp. July 1960. 7 On8P

Questions and answers were given on farm drainage assistance for farmers by various departments of the Ontario government.

3376. Irwin, R. W. LAYING TILE BY HAND. Ontario Dept. Agr. P. 36, 7 pp. Mar. 1961. 7 On8P

A pictorial report was given on laying small lines of drainage tile by hand.

3377. Irwin, R. W. FARM TILE DRAINAGE ASSISTANCE. Ontario Dept. Agr. P. 4, 6 pp. June 1963. 7 On8P

A report was given on farm tile drainage assistance in Ontario, Canada.

3378. Ivitskii, A. I., and Filonovich, P. K. SEDIMENTATION OF TILE DRAINAGE IN MINERAL SOILS. (Rus) Gidrotekh. i Melior. 6: 33-39. June 1964. 290.8 G362

3379. Jaakkola, O. ABOUT THE WORK OF THE LAND CLEARING CO.: IN MAKING BASIC IMPROVEMENTS IN THE FINNISH AGRICULTURE. (Fi) Teho. 7/8: 513-518. 1955. 20 T98
English summary.

A report was given on the work done by the Land Clearing Company to make basic improvements in Finnish Agriculture.

The worst obstacles to the mechanization of the agricultural fields were: Poor drainage systems with the need for artificial drainage with open ditches or closed drains; stoniness; small and irregular shaped fields; and scattered fields. The report included the progress of artificial drainage by the Land Clearing Company.

3380. Jager, A. W. De. CLOGGING OF THE JOINTS IN DRAINAGE DITCHES. (Du) Nederland Heidemaatsch. Tijdschr. 70(9): 199-200. Sept. 1959. 12 N282

3381. Jager, A. W. De. REVIEW OF PLASTIC DRAINAGE IN THE NETHERLANDS. Netherlands J. Agr. Sci. 8(4): 261-270. Nov. 1960. 12 N3892

A review was given of experiences with plastic drains installed by a mole plow in the Netherlands. Sand tank investigations were reported where a comparison was made between plastic pipes and normal tile drains.

3382. Jager, A. W. De. SPUN GLASS; A NEW MEANS FOR THE PREVENTION OF CLOGGING DRAINAGE PIPES. (Du) Groenten en Fruit. 16(22): 704-705. Dec. 1, 1960. 80 G89

3383. Jarvis, M. W. SUBSOIL DRAINAGE TRIAL FOR HEAVY SOILS. J. Agr. [Melbourne] 57(3): 143-144. Mar. 1959. 23 V66J

A progress report was given on a subsoil drainage trial in heavy soil in Australia. Tile drainage with and without surface drainage and mole drainage are being tested in the six trials.

3384. Johnston, W. R., Pillsburg, A. F., and Shaw, E. GLASS FIBER FILTERS FOR TILE DRAINS. Calif. Agr. 17(10): 8-9. Oct. 1963. 100 C12Cag

A report was given on the use of glass fiber filters for tile drains in California.

3385. Jones, B. A. SUMMARY: EFFECTIVENESS OF BACKFILL MATERIALS FOR TILE DRAINS (A SYMPOSIUM). Trans. ASAE 5(1): 67. 1962. 290.9 Am32T

A summary was given of the three papers presented at this symposium on the effectiveness of backfill material for tile drains.

3386. Juusela, T. ON THE METHODS OF PROTECTING DRAIN PIPES AND ON THE USE OF GRAVEL AS A PROTECTIVE MATERIAL. Acta Agr. Scand. 8(1): 63-87. Ref. 1958. 11 Ac82

The use of gravel in Finland as a protective material for tile drainage was given. Use of 5 cm. of gravel and then a 15-20 cm. layer of humus topsoil on top of the tile were stressed. Only 4.3 percent of 854 farms reported damage from silting when the gravel pack was used. The cost of gravel placement was estimated at 3 to 4 percent of the completed drainage project.

3387. Juusela, T. MOLE DRAINAGE WITH PLASTIC STRIP LINING. Cong. Irrig. and Drain. Trans. 4(6): C.387-C.390. 1960. 55.9 C7652

An illustrated report was given on mole drainage with plastic strip linings in Finland and other areas.

3388. Juusela, T. ON THE POSSIBILITIES FOR DECREASING THE COST OF COVERED DITCHES. (Sw) Grundforbattring. 13(1): 39-54. Ref. 1960. 54.8 G92

3389. Kaptein, L. A., and Zwan, L. M. Van Der. RUST DEPOSITS IN FEN DRAINAGE PIPES. (Du) Netherlands Rlandbvoorlichtingsdienst. Landbvoorlichting. 20(1): 34-42. Jan. 1963. 12 N383M

3390. Kingsley, Q. S., and Shubeck, F. E. THE EFFECTS OF ORGANIC TRENCHING ON RUNOFF. J. Soil and Water Conserv. 19(1): 19-22. 1964. 56.8 J822

A review of the literature and results obtained in an experiment on the effects of organic trenching on runoff were given.

A trenching tool that used wheat straw bales as an organic wedge was described and illustrated.

The use of organic trenching was compared with the following treatments: (1) Area subsoiled with a 2 inch wide point; (2) use of trench without organic trenching; (3) 20 lb. of nitrogen; (4) sweetclover planted with a small grain; and (5) check plot.

3391. Klimko, A. I., and Shevelev, Y. Z. SILTING OF TILE DRAINAGE AND ITS CLEANING BY FLUSHING. (Rus) Gidrotekh. i Melior. 4: 38-43. Apr. 1963. 290.8 G362

3392. Koning, J. C. De., and Kampen, J. H. Van. EXPERIENCES WITH PLASTIC-DRAINAGE IN THE ZUIDERZEE POLDERS. Cong. Irrig. and Drain. Trans. 5(5): R.17.279-R.17.284. 1963. 55.9 C7652

Experiences were reported of using plastic pipes in the Zuiderzee Polders in the Netherlands. The cost of installed plastic pipes was more than the installed clay tiles.

3393. Kotsyuba, N. L. MOLE DRAINING IS AN EFFECTIVE MEASURE. (Rus) Sel'sk. Khoz. Sev. Kavkaz. 11: 37. Nov. 1962. 20 Se495

3394. Kuntze, H. NEW DRAINAGE FILTERING MATERIAL. (Ge) Lohnunternehmen in Land- u. Forstwirt. 19(3): 65-66. Mar. 15, 1964. 58.8 D81

3395. Lewandowski, A., and Madrowa, M. AN ATTEMPT TO PREVENT BY CHEMICAL METHODS THE GROWTH OF IRON BACTERIA IN DRAINAGE. (Pol) Rocz. Nauk Roln. 88-A-2: 223-234. Ref. 1964. 20.5 R59
English summary.

A report was given of the use of compounds of zinc, cadium, and mercury in Poland to prevent the growth of iron bacteria in drain tile lines.

3396. Lindqvist, R. MORE FROST RESISTANT TILE DRAINS ARE NEEDED. (Sw) Lantmannen. 73(6): 126-127. Feb. 10, 1962. 11 L234

3397. Loayza, G. C. PIPE DRAINAGE ON THE CARTAVIO SUGARCANE PLANTATION. (Sp) Azucar. 3(10): 33-47. Ref. July 1956. 65.8 Az8

3398. Luik, H. COVERED DITCHES AND ITS ADVANTAGES. (Sw) Vasterbotten. 32(2): 43-48. Mar. 1959. 11 V442

3399. Lyons, T., Werenfels, L., and Houston, C. FILTER ENVELOPES AID TILE DRAINAGE IN SACRAMENTO—SAN JOAQUIN DELTA TESTS. Calif. Agr. 18(3): 14-16. Mar. 1964. 100 C12Cag

A report was given on the value of glass fiber filters and safflower straw for use with perforated bituminized fiber and plastic subsurface tile drains on muck soils in California.

3400. Mackenzie, A. J. CHEMICAL TREATMENT OF MINERAL DEPOSITS IN DRAIN TILE. J. Soil and Water Conserv. 17: 124-125. 1962. 56.8 J822

Investigations into the malfunction of tile drainage systems in the Imperial and Coachella Valleys of California revealed the presence of mineral deposits which were affecting the performance of the drain tiles. The inside of the tiles, particularly the joints between the tiles, contained accumulations of insoluble mineral materials that clogged the joints and restricted water entry into the drainage systems. In some cases, drainage lines were affected to such an extent that a water table had developed over the lines and the increased soil salinity had severely inhibited plant growth.

Two types of deposits that caused malfunction of drainage systems were found in tile sections. One was a black material consisting mainly of manganese oxide, the other was a reddish-colored material that resembled ordinary iron rust and was predominately iron oxide. Either one or both of the deposits were found in both concrete and clay tile systems.

Research was reported for the chemical treatment for this problem.

3401. McLean, R. D. RECLAMATION OF LAND IN THE MOURNES. North Ireland Min. Agr. Mon. Agr. Rpt. 31: 204-205. Nov. 1956. 256.13 Ag82M

A report was given on the drainage of moor land by stone drains in Ireland.

3402. Makharadze, A. A. MOLE DRAINAGE OF SOIL ON OVERMOISTED TEA PLANTATIONS. (Rus) Makharadze. Vses. Nauch.-Issled. Inst. Chaya Subtrop. Kul't. Subtrop. Kul't. 2: 25-34. 1964. 68.19 M28
English summary.

A report was given on the use of mole drainage and mole drainage machinery for tea plantations in West Georgia (U.S.S.R.).

3403. Martin, C. K., and Lang, A. L. BETTER DRAINAGE FOR CLAYPAN SOILS. Ill. Res. 2(3): 5. Summer 1960. 100 IL64

Research was reported on the use of 4 inch holes drilled 10 feet deep to provide better drainage for claypan soils in Illinois. A tile line was established 5-1/2 feet deep in the area difficult to drain.

3404. Maslov, B. S. DRAINAGE SYSTEMS IN THE BOTTOMLAND OF YAKHROMA RIVER AND THE TILE DRAINAGE CONSTRUCTION. (Rus) Gidrotekh. i Melior. 11: 46-50. Nov. 1963. 290.8 G362

3405. Meyer, J. L. APRICOTS AND PEARS: WATER TABLE CONTROL WITH DRAINAGE TILE. Western Fruit Grower. 17(5): 28. May 1963. 95.8 G762

A report was given on the use of clay tile for drainage of apricots and pears in a low-lying, poorly drained area in Stanislaus, Calif.

3406. Miers, R. H. DRAINAGE OF LAND FOR POULTRY. Poultry and Egg Prod. Assoc. Great Britian Ybk. 1962: 11-16. 1962. 47.9 P864Y

A report was given on the tile drainage of land used permanently for poultry in Great Britian.

3407. Mika, Z. THE PROBLEM OF THE LONGEVITY OF MOLE DRAINAGE. (Cz) Ceskoslov. Akad. Zemedel. Ved. Sborn. Lesn. 32(4): 427-442. Ref. Apr. 1959. 99.9 C334
German summary.

3408. Mitin, V. F. DRAINAGE OF PEAT SOILS BY MEANS OF DEEP CANALS WITH INFREQUENT SPACINGS. (Rus) Gidrotekh. i Melior. 1960(4): 35-40. Apr. 1960. 290.8 G362

3409. Mohrmann, J. PROBLEMS CONNECTED WITH DRAINAGE BY CANALS. (Fr) Belgium Min. des Colon. B. Agr. du Congo Belge. 47: 1501-1518. Ref. Dec. 1956. 24 K83

3410. Morgan, A. THE DRAINAGE OF "SOAKS". J. Agr. [Melbourne] 62(2): 65-66. Feb. 1964. 23 V66J

A report was given on the value of tile drainage on "soaks" (extremely wet areas) in Australia.

3411. Mueller, O. PROBLEMS OF WATER MANAGEMENT IN SUGAR CANE. Deccan Sugar Tech. Assoc. (India) Annu. Conv. 14(1): 123-126. 1957. 65.9 D35

The needs of drainage on sugarcane soils with a high water table were given for India. The use of mole drains leading into open ditches was stressed.

3412. Muzychuk, I. MOLE DRAINAGE IN RECLAMATION OF SALTY SOILS. (Rus) Khlopkovodstvo. 7(10): 57-60. Oct. 1957. 72.8 K522

3413. Myers, D. J. HOW WATER RUNS INTO MOLE DRAINS. Dairyfarming Digest. 5(1): 11-12. Jan./Feb. 1958. 44.8 D1443

Mole drains are usually made only in soils which have almost water-tight clay subsoils. The mole channel or drain should be placed in the heaviest clay part of the subsoil. The use of mole drain in these soils in Australia was described and illustrated.

3414. Nagasaki, A. STUDIED ON THE MOLE-DRAIN UNDER PADDY FIELDS FOR THE SIMPLE METHOD OF UNDERDRAINAGE. (Ja) Iwate U. Facul. Agr. J. 6(1): 142-219. Ref. Nov. 1962. 107.6 Iw93 English summary.

A report was given on the use and durability of mole-drains for paddy fields in Japan.

3415. Nathan, K. STUDIES AIMED AT IMPROVING TILE DRAINAGE ON N.J. FARMS. N.J. Agr. 41(3): 4-6. 1959.

A study is under way to answer some of the questions on proper installation of tile drains Piezometers were placed in sets of 6 at depths of 1, 1-1/2, 2, 2-1/2, 3, and 3-1/2 feet below the ground surface; over the tile, 3, 8, 18, 30, and 50 feet to either side of the tile. By periodically measuring the water in these piezometers it was possible to follow the movement of the free water. The maximum daily average flow was in excess of 75 gallons a minute, but rates as high as 115 gallons per minute were reached for shorter periods.

On Fallsington silt loam the drawdown between the tile lines which were spaced 100 feet apart, showed a maximum drop of 2.3 feet in 24 hours where the tile was placed 3.2 feet deep.

On Dolonton sandy loam the maximum drop was only 4 inches in 24 hours. The spacing of the laterals here was also 100 feet, but the depth was 2.6 feet.

3416. Nelson, R. W. FIBERGLASS AS A FILTER FOR CLOSED TILE DRAINS. Agr. Engin. 41(10): 690-693, 700. Oct. 1960. 58.8 Ag83

Research results were presented on fiber glass as a filter for closed tile drains. The reinforced fiber glass was recommended over the ordinary fiber glass material.

3417. Neudecker, J. DRAIN FLUSHING INSTALLATIONS FOR ELIMINATION OF DEPOSITED OCHER. (Ge) Oesterr. Wasserwirt. 8(3): 67-72. Mar. 1956. 55.8 Oe8

3418. Nilsson, R. COVERED DRAINAGE DITCHES ARE OFTEN NECESSARY. (Sw) Hallands Lans Hushsalisk. Tidskr. 5(4): 15-17. July 1962. 11 H152

3419. North Rhine-Westphalia. THE INSTALLATION OF NON TUBULAR MOLE DRAINS. (Ge) Die Anlage unberohrter Maulwurfdranungen. Landesaussch. f. Landwirt. Forsch. Erzieh. u. Wirt.-Beratung. Merkbl. 83, 15 pp. Ref. Aug. 1956. 18 D94

3420. Northern Ireland Ministry of Agriculture. FIELD DRAINAGE. North Ireland Min. Agr. Mon. Agr. Rpt. 32(6): 166-169. Oct. 1957. 256.13 Ag82M

A report was given on the use of field drains in Ireland. The use and maintenance of stone drains, tile drains, sod drains, mole drains, and drainage outlets were discussed.

3421. Olbertz, M. H. IS DRAINAGE WITH PLASTIC PIPES RIPE IN PRACTICE? (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(12): 445-448. Ref. Dec. 1964. 18 W763

3422. Overholt, V. FIBER GLASS FILTERS FOR TILE DRAINS. Agr. Engin. 40(10): 604-607. Oct. 1959. 58.8 Ag83

Experimental results were given from a project testing fiber glass filters for tile drains to prevent siltation in fine sandy loam soils.

3423. Panenko, I. MOLE DRAINAGE. (Rus) Kartofel' i Ovoshchi. 2: 28-30. Feb. 1964. 75.8 K147

3424. Pasini, B. HYDRAULIC-AGRARIAN RECLAMATION OF FERRARA RICE FIELDS. (It) Agr. Ferrarese. 62(2): 27-32. (Cont.) Feb. 28, 1958. 16 Ag87

3425. Pattimore, E. SUBSURFACE DRAINAGE SYSTEMS FOR MOSQUITO SOURCE REDUCTION. Calif. Mosquito Control Assoc. Proc. and Papers, 31: 67-68. 1963. 428 C763

A report was given on the use of subsurface drainage to reduce mosquitoes in California.

3426. Pedrero, J. J. COST OF "PIPED" TILE DRAINAGE FOR AGRICULTURAL USE. (Sp) Ingen. Hidraul. en Mex. 15(1): 69-88. map. Jan./Mar. 1961. 290.8 In43
English summary, yellow pages, pp. III-IV.

A report was given of the cost of "piped" tile drainage in Mexico. Various machinery used to lay the tile were described and illustrated.

3427. Piper, B. M. MOLE DRAINS FOR ORCHARDS. New Zealand J. Agr. 96(4): 340-341, 343, 345. Apr. 15, 1958. 23 N48J

A report on the drainage problems in New Zealand orchards planted on heavy clay soils that have an impervious subsoil and the use of mole drains to correct the situation was given. Open drains were used as outlets for the mole drains. A 2 inch or 2-1/2 inch plug was recommended for orchard use.

3428. Poiree, M. AGRICULTURAL RECLAMATION; DRAINAGE BY PIPE OR TRENCH; REGULATION OF WATER COURSES AND OUTLETS. (Fr) Entierement nouvelle Ed. Paris, Eyrolles, 439 pp. 1962. 54 P752

3429. Portland Cement Association. CONCRETE TILE FOR FARM DRAINAGE. Chicago. 5 pp. 1954. 54 P832

An illustrated report was given on the installation and use of concrete tile for farm drainage.

3430. Post, C. J. Van Der, and Schie, J. J. Van. SUB-DRAINAGE OF SANDY SOILS. (Du) Naaldwijk. Proefsta. v. de Groenten- en Fruitteelt onder Glas. Jaarverslag. 1959: 37-38. 86 N112J
English summary, pp. 154.

A report was given on the need of subsurface drainage of sandy soil in the Netherlands. The use was recommended of subsurface drainage plugs pump drainage from pits.

3431. Quinn, E. DRAINAGE IN THE DRUMLIN BELT. Farm Res. News. 1(6): 9-12. map. Jan./Feb. 1961. 10.5 F223

A report was given on research projects on the use of tile, stone surface drains, and mole drains for the Drumlin Belt of Ireland.

3432. Rafaelian, A. S. RESULTS OF EXPERIMENTS IN MOLE DRAINAGE OF MARSHY SOILS IN THE AREA OF ARAS LOWLAND. (Rus) Akad. Nauk Armianskoi SSR. Izv. Biol. i Sel'skokhoz. Nauk. 8(8): 15-27. Ref. Aug. 1955. 20 Er4

3433. Ramsauer, B. MOLE DRAINAGE. (Ge) Unveranderte Neuaufl. Petzenkirchen, 29 pp. 1957. 54 R142

3434. Reque, J. H. TILE DRAINAGE IN SOUTHERN MINNESOTA. Crystal-ized Facts. 18(3): 43-45. Winter 1964/65. 66.9 C88

A report was given on the need and use of tile draianage for sugar beets in southern Minnesota.

3435. Rid, H. MOLE DRAINAGE FOR IMPROVING WATER VOLUME AND AERATION OF SOILS. (Ge) Tech. u. Landwirt. 8: 308-309. July 10, 1956. 58.8 T223

3436. Riha, J. ON THE PROBLEM OF INVESTMENT CAPITAL RETURNS IN TILE DRAINAGE. (Cz) Ceskoslov. Akad. Zemedel, Ved. Sborn. Zemedel. Ekon. 34(11): 817-826. Ref. Nov. 1961. 281.9 C332

3437. Romanenko, A. M. FOR A REDUCTION IN THE COST OF RECLAIMING SWAMPS AND PEAT BOGS, BY EMPLOYING CLOSED DRAINAGE. (Rus) Gidrotekh. i Melior. 8(7): 23-28. July 1956. 290.8 G362

3438. Rowan, J. S., and Hickey, T. J. LAND IMPROVEMENT SCHEMES IN FINLAND. Ireland Dept. Agr. J. 58: 86-101. map. Autumn 1961. 10 Ir2J

Land improvement schemes in Finland by drainage were described.

3439. Royer, A. E. RECLAMATION OF DRAINAGE DITCH SPOIL THROUGH USE OF FERTILIZER AND LIME. Ga. Agr. Res. 2(4): 4-5. 1961. 100 G295

A report was given on the reclamation of drainage ditch spoil in Georgia through the use of fertilizer and lime.

3440. Sakovich, F. I. ROENTGENOSCOPIC METHOD OF INVESTIGATING MOLE DRAINAGE IN PEAT [SOILS]. (Rus) Akad. Nauk Belorusskoi SSR. Izv. 4: 89-92. July/Aug. 1955. 511 M663

3441. Sakovich, F. I. SOME PROBLEMS OF THE STABILITY OF MOLE DRAINS ON PEAT SOILS. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, pp. 174-185. Ref. Minsk, 1956. 54.9 K83

3442. Sakovich, F. I. ON THE USE OF TUBULAR DRAINAGE IN POLAND. (Rus) Gidrotekh. i Melior. 8(11): 54-57. Nov. 1956. 290.8 G362

3443. Sakovich, F. I. UTILIAATION OF MOLE DRAINAGE ON THE PEAT SOILS OF BELORUSSIAN SSR. (Rus) Zemledelie. 6(2): 90-91. Feb. 1958. 20 Z44

3444. Salinger, J. P. SOIL IMPROVEMENT IN THE FLOWER GARDEN. New Zealand J. Agr. 93: 409, 411-413. Oct. 1956. 23 N48J

The use of open channels, inverted box drains, tile drains, liming, and cultivation were discussed for flower gardens in New Zealand.

3445. Scholz, A. POSSIBILITIES OF MOLE DRAINAGE IN PRACTICE. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 4(1): 42-45. Ref. Jan. 1963. 18 W763

3446. Scholz, A. THE PRIMARY SILTING UP OF PRESSED MOLE DRAINS ON LOW-LYING PEAT LANDS AND ITS MEASUREMENT BY THE SO-CALLED MOLE-PLUMMET. (Ge) Z. f. Landeskult. 4(3/4: 227-245. Ref. 1963. 282.9 Z3
English summary.

A report was given on the silting of pressed mole drains on low-lying peat lands in East Germany. A method was described to measure the silting of these mole drains.

3447. Schwab, G. O. PLASTIC TUBING FOR SUBSURFACE DRAINAGE. Agr. Engin. 36: 86-89. 1955. 58.8 Ag83

Results of a 5-year research study pointed up the physical and economic feasibility of perforated plastic tubing as a means of subsurface drainage of agricultural lands.

3448. Scott, J. F. PRODUCTION AND MANAGEMENT BENEFITS FROM MOLE DRAINAGE. New Zealand J. Agr. 97(5): 419. Nov. 15, 1958. 23 N48J

The intelligent use of a mole plow achieved outstanding results on wet land suited for this type of drainage in New Zealand. The minimum requirements for success were: (1) A plastic clay subsoil free from subsurface obstructions; and (2) a general surface fall toward the outlet.

3449. Seppala, N. UTILIZATION OF DRAIN TRAPS WITH A VIEW TO AVOIDING COVERED DRAINS BECOMING BLOCKED WITH RUST. (Fi) Suomen Maataloustiet. Seura. Maataloustiet. Aikakausk. 30(4): 233-243. 1958. 20 Su7M
English summary.

It was found in Finland that most stoppages in drainage pipes could be retarded and possibly eliminated by means of drain traps for covered drains. The drain traps should be 2 to 3 meters long as well as watertight.

3450. Shalhevet, J. THE FEASIBILITY OF MOLE DRAINAGE FOR CERTAIN SOILS. (Abs.) Israel Res. Council B. 8G(2/3): 164-165. Aug./Nov. 1959. 330.9 Is72B

An abstract was given on the feasibility and durability of mole drainage on certain soils in Israel.

3451. Sharpe, M. IRON EATING BACTERIA. Citrus Indus. 44(5): 24. May 1963. 80 C49

A report was given on the use of slag gravel to prevent clogging by iron bacteria of drainage pipes made of fiber and tile in Florida citrus soils.

3452. Shearer, M. N. DRAINAGE AROUND HOMES ON LEVEL GROUND. Oreg. State Col. Ext., Ext. C. 607, 6 pp. folder. May 1956. 275.29 Or32C

A report was given on the use of drainage on homes built on level ground in Oregon.

3453. Shearer, M. N. LAND DRAINAGE IS A CONSERVATION PRACTICE. Oreg. State Col. Ext., Ext. C. 623, 6 pp. folder. Jan. 1957. 275.29 Or32C

An illustrated leaflet was given on the use of tile drainage in Oregon.

3454. Sherstoboev, N. Y. HISTORY OF DRAINAGE OF LANDS BY MEANS OF BURIED DRAINAGE IN THE USSR. (Rus) Gidrotekh. i Melior. 1962(3): 46-54. (Cont.) Mar. 1962. 290.8 G362

3455. Sherstoboev, N. Y. HISTORY OF RECLAMATION OF LAND BY BURIED DRAINAGE IN THE USSR. (Rus) Gidrotekh. i Melior. 1962(4): 47-56. (Concl.) Ref. Apr. 1962. 290.8 G362

3456. Shileika, V. I. TILE PRINCIPAL MEASURES ON PROLONGING THE SERVICE LIFE OF DRAINAGE. (Rus) In DONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHEMYKH POCHV, 1955. Trudy, pp. 115-120. Minsk, 1956. 54.9 K83

3457. Shkinkis, T. N. REGULAR, COMBINED AND DISPERSED DRAINAGE. (Rus) Vest. Sel'skokhoz. Nauki. 1961(11): 94-104. Ref. Nov. 1961. 20 V633
English summary.

The hydrological effects of various types of closed drains were discussed. Recommendation for their application were given.

3458. Shoji, F., Nagasaki, A., Ishikawa, T. and Wakui, M. STUDIES ON THE MOLE DRAIN. II. (Ja) Nogyodoboku-Kenkyu. 26(4): 181-186. Nov. 1958. 290.8 N68

3459. Shoji, F., Nagasaki, A., Ishikawa, T., and Wakui, M. STUDIES ON THE MOLE DRAIN. III. ON THE DURABILITY OF THE MOLE DRAIN HOLE IN PADDY FIELD. (Ja) Nogyodoboku-Kenkyu. 27(3): 119-125. Aug. 1959. 290.8 N68
English summary.

A report was given on the durability of unlined mole drains in paddy fields in Japan.

3460. Shreider, V. EFFECTIVENESS OF USING PLASTIC PIPES FOR DRAINAGE. (Rus) Ekon. Sel'sk. Khoz. 1962(2): 80-84. Feb. 1962. 281.8 So73

3461. Sine, L. RECENT TECHNIQUES ON WATER MOVEMENT IN SUBTERRANEAN DRAINAGE CANALS: CHOICE OF MATERIALS FOR THE SOIL CONDITIONS (PLASTIC TUBES, OTHER MATERIALS, AND MOLE DRAINS). (Fr) Internatl. Congress Agr. Engin. 6(I): 15-25. 1964.

Reports on the use of plastics for mole drains were summarized for the following three groups: (1) New techniques using prefabricated plastic tubes or plastic lined mole drains; (2) practical use of new techniques; and (3) new calculation methods.

3462. Sisson, D. R. TILING FOR 30,000. Land Impr. 2(11): 15, 35. Nov. 1955. 282.8 L224

A report was given on a tile drainage demonstration held in Wabush, Ind., in connection with the National Conservation Days and National Plowing Contests, Sept. 14-17, 1955. This cooperative project showed 30,000 people how good farm land could be made from bad in the Upper Mississippi Valley.

3463. Sisson, D. R., and Austin, R. H. FOLLOW THESE SUGGESTIONS FOR GOOD TILE DRAINAGE. Purdue U. Ind. Agr. Ext., Ext. C. 458, 6 pp. folder. 1959. 275.29 In2E

Suggestions were given for tile drainage practices in Indiana.

3464. Sisson, D. R., and Jones, B. A. FILTER MATERIALS FOR TILE DRAINS IN A MEDIUM SAND—A LABORATORY COMPARISON. Trans. ASAE 5(1): 54-58. 1962. 290.9 Am32T

A laboratory comparison was reported on filter materials for tile drains in a medium sand. The following filter materials were used: Fiber glass with plastic; straw; sawdust; gravel; fiber glass (270-deg.-warp); topsoil; corncobs; and check or none.

3465. Skoric, A., and Mihalic, V. WAYS OF AMELIORATION OF PSEUDOGLEY IN CROATIA. (Se) Agrohemija. 7: 403-418. Ref. 1964. 385 Ag87
English summary.

A report was given of the use of mole drainage and tillage to improve pseudogley soils in Croatia.

3466. Skov, K. S. OCHER TRIALS. (Da) Hedeselsk. Tidsskr. 81(4): 71-75. Mar. 25, 1960. 11 H35

3467. Skov, K. S. FINE SAND AND DRAINAGE PIPES. (Da) Hedeselsk. Tidsskr. 84(15): 363-367. Dec. 10, 1963. 11 H35

3468. Smith, F. D. DRAINING A HILL FIELD. Great Britian Min. Agr. Fisheries and Food Agr. 68(2): 78-81. May 1961. 10 G79J

A report was given on the use of mole drainage in hill fields in England.

3469. Sorokin, M. PLOWING AND MOLE DRAINAGE OF FLOOD PLAIN SOILS. (Rus) Zemledelie. 5(9): 43-46. Sept. 1957. 20 Z44

3470. Spain, J. M., and Liljedahl, J. B. VERTICAL MULCHING. World Crops. 12(11): 419-421. Nov. 1960. 281.8 W892

A report was given on the use of vertical mulching in the United States to improve drainage from subtilling the land.

3471. Spencer, W. F., Patrick, R., and Ford, H. W. THE OCCURRENCE AND CAUSE OF IRON OXIDE DEPOSITS IN TILE DRAINS. Soil Sci. Soc. Amer. Proc. 27(2): 134-137. Ref. Mar./Apr. 1963. 56.9 So3

A report was given on a red sludge-like deposit found in some tile systems in Florida citrus groves caused primarily by "iron bacteria".

3472. Strain, R. J. LAND DRAINAGE. Agr. North Ireland. 38(7): 210-212. Nov. 1963. 256.13 Ag82M

A report was given on the need and use of land drainage in Ireland.

3473. Sutton, J. G. INSTALLATION OF DRAIN TILE FOR SUBSURFACE DRAINAGE. J. Irrig. and Drain. Div., ASCE 86(IR 3, 2591): 27-49. Sept. 1960. 290.9 Am3Ps

Current progress was given on the installation of tile drains for subsurface drainage. The benefits of tile drainage were given. Tile used in combination with surface drainage was discussed. The current procedures used by the Soil Conservation Service in making drainage investigations were given along with recommendations for clay tile, concrete tile, and gravel filter requirements.

3474. Sutton, J. G. INSTALLATION OF DRAIN TILE FOR SUBSURFACE DRAINAGE. Amer. Soc. Civil Engin. Trans. 126(3): 136-158. Ref. 1961. 290.9 Am3

Current progress was given on the installation of tile drains for subsurface drainage. The Soil Conservation Service provided technical assistance on installation of 24,059 miles of tile drains during the 1959 fiscal year. Benefits of tile drainage were given and tile used in combination with surface drainage and current procedures used by the Soil Conservation Service in making drainage investigations were described. Recent changes in the American Society of Testing Materials specifications for clay and concrete drain tile were discussed. Recommendations were given for use of concrete tile under acid and alkali conditions. Recommendations for gravel filter requirements were given.

3475. Swift, A. COVERING OF OPEN DITCHES. (No) Ny Jord. 48(1): 6-15. 1961. 282.28 N98

3476. Tajino, N. STUDIES OF IMPROVED EXECUTION TECHNIQUES OF UNDERDRAINAGE. II. (Ja) Tokyo Natl. Inst. Agr. Sci. B. Ser. F (Agr. Engin.) 13: 137-163. Mar. 1961. 290.9 T57 English summary.

A report was given on the durability of bamboo stalks, fascine, and tile used for subsurface drainage in Japan. General advice was given on the costs and methods of installing underdrains.

3477. Tajino, N. STUDIES OF IMPROVED EXECUTION TECHNIQUES OF UNDERDRAINAGE. III. (Ja) Tokyo Natl. Inst. Agr. Sci. B. Ser. F (Agr. Engin.) 13: 165-169. Mar. 1961. 290.9 T57 English summary.

A report was given on the effectiveness of underdrain materials in Japan. Glass fiber cloth was recommended for enveloping tile.

3478. Talsma, T., and Haskew, H. INVESTIGATION OF WATER-TABLE RESPONSE TO TILE DRAINS IN COMPARISON WITH THEORY. J. Geophysical Res. 64(11): 1933-1944. Ref. Nov. 1959. 470 J823

An investigation of the performance of tile laterals, selected from farm drainage systems was reported. Useful theories of water-table response to tile lines were briefly reviewed. The field procedure used for the investigation was described.

Average hydraulic conductivity was determined from in-place measurements by the augerhole and piezometer methods. The position of the impermeable layer was determined from textural examination of the soil and from piezometer measurements of hydraulic conductivity. The performance of laterals was investigated by simultaneous measurements of water-table height along lines at right angles to the tile and rate of discharge from the tile line.

3479. Thomaser, F. STUDY OF THE CLOGGING OF DRAINAGE SYSTEMS AND THEIR CLEANING. (Ge) Oesterr. Wasserwirt. 16(7/8): 159-163. July/Aug. 1964. 55.8 Oe8

3480. T'Jonck, G., and Graeve, G. De. DRAINAGE TRIALS ON SOILS DEVELOPED FROM SANDY SEDIMENTS IN SOUTHERN CAMPINE IN BELGIUM. (Fr) Internatl. Cong. Agr. Engin. 6(II): 181-191. 1964.

Reports on tile drainage and mole drainage in Belgium were given. Different types of filter materials were tested and compared.

3481. Trzebinska, M. INVESTIGATIONS ON THE DURABILITY OF MOLE DRAINAGE. (Po) Wroclaw. Wyzsza Szkola Roln. Zeszyty Nauk. Melior. 5: 65-73. 1960. 54.9 B75 English summary.

Investigations were reported on the durability of mole drains in Poland.

3482. Turbin, V. N. UTILIZATION OF MOLE DRAINAGE TO INCREASE PRODUCTIVITY OF TEMPORARILY EXCESSIVELY MOISTURIZED HEAVY SOILS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiriazeva. Dok. Tskha. 36: 207-213. 1958. 20 M857

3483. Turbin, V. N. MECHANISM OF WATER ENTERING MOLE DRAINS AND THE INFLUENCE OF MOLE DRAINAGE ON THE WATER PERMEABILITY OF HEAVY MINERAL SOILS. (Rus) Timiriazevskaia Sel'skokhoz. Akad. Izv. 1(26): 175-190. 1959. 106 P44 English summary.

The ways that water enters mole drains were studied in Russia, along with the influence mole drainage was on the water permeability of heavy mineral soils.

3484. Turbin, V. N. DRAINAGE EFFECTIVENESS OF SUBSURFACE WATER COLLECTORS IN THE FAR EAST. (Rus) Gidrotekh. i Melior. 12: 34-42. Dec. 1963. 290.8 G362

3485. Tuttle, R. E. DRAIN TILE—HOW ARE THEY WORKING? Soil Conserv. 25(2): 39-41. 1959. 1.6 So3S

Since the beginning of the Skagit County Soil Conservation District in Washington, many farmers have installed tile lines. Occasionally, tile lines had been opened to check for silting, but no overall evaluation had been made by systematically opening many tiles that had been installed for years.

It was decided: (1) To check tile deterioration; (2) to test the acidity of the surrounding soil; and (3) to investigate the condition of the straw blanket or wood chippings around the tile after several years' use. The results of the investigation were reported.

3486. Vaigneur, H. O. PLASTIC LINERS MAY REDUCE SUBSURFACE DRAINAGE COSTS. S.C. Agr. Res. 6(3): 5-6. Fall 1959. 100 So8So

A report was given on the use of plastic liners for mole drains to reduce subsurface drainage costs in South Carolina.

3487. Velychko, M. F. MOLE DRAINAGE OF PEAT BOGS. (Uk) Lutsk. Volyns'ka Derzhavna Sil's'kohospodar. Doslid. Sta. Nauk. Pratsi. 1: 91-96. 1961. 106 L972

3488. Verhoeven, B., Bakker, D., Kluytenaar, J., and Sieben, W. H. THE RECLAMATION OF THE QUARLES POLDER. (Du) Van Zee tot land 20, 43 pp. 1957. 54.8 V26
English summary.

A report was given on the reclamation of the Quarles polder in the Netherlands. Open drains were necessary at first. These were followed by tile drains

3489. Wallack, B. DRAINAGE AND FLORIDA'S CITRUS LAND. J. Soil and Water Conserv. 14(5): 226-227. Sept. 1959. 56.8 J822

A report was given on the use of bituminized fiber pipes for drainage of citrus land in Florida. Citrus trees need at least 4 feet of well drained land in which to grow healthy, large root systems.

3490. Watts, D. G., and Luthin, J. N. TESTS OF THICK FIBERGLASS FILTERS FOR SUBSURFACE DRAINS. Hilgardia. 35(3): 33-46. Sept. 1963. 100 C12H

A report was given on a series of tests of fiber glass filters for subsurface drains in California.

3491. Wegmayr, G. SIX YEARS OF EXPERIENCE WITH MOLE DRAINAGE IN SALZBURG. (Ge) Forderungsdienst. 12(6): 197-198. June 1964. 19 F75

3492. Wheaton, R. Z., Kidder, E. H., and Cutler, W. A. STABILITY AND DURABILITY OF UNDERDRAINS IN AN ORGANIC SOIL. Mich. Agr. Expt. Sta. Q. B. 40(3): 555-560. Feb. 1958. 100 M58S

A report was given on the stability and durability of clay tile, concrete tile, steel pipe, and fiber pipe for subsurface drainage in a Houghton muck soil in Michigan.

3493. Whimster, G. S. THE CARSE OF GOWRIE. Scotland Agr. 39(2): 92-94. Autumn 1959. 10 Sco82So

A report was given on farming systems in the Carse of Scotland. A history of the tile drainage for the area was given along with some remarks on modern trends of drainage.

3494. Williams, S. G. DRAINAGE COMES FIRST IN PASTURE IMPROVEMENT ON THE MURRAY SWAMPS. II. SPECIAL PROBLEMS THAT NEED SPECIAL ATTENTION. So. Australia Dept. Agr. J. 65(6): 234-240. Jan. 1962. 23 So84

The use of mole drains, tile drains, unglazed earthenware pipe, and box drains were discussed for pasture drainage in South Australia. The use of drainage to reclaim saline areas was also stressed.

3495. Wood, J. B. DRAINAGE BENEFITS FROM WORKING TOGETHER. (Abs.) Assoc. Southern Agr. Workers Proc. 56: 245-246. 1959. 4 C82

The advantage of a group drainage project in South Carolina were given. A canal 7 1/2 miles long was dug that furnished a main outlet of 10,600 acres of poorly drained farm land.

3496. Yakovlev, B. I., and Leushev, A. N. PERIODS OF SERVICE OF PLANK DRAINAGE IN LOAMY SOILS. (Rus) Belorusskaya Sel'skokhoz. Akad. Trudy. 35: 95-113. 1961. 106 B415

3497. Yunevich, D. P., and Levin, M. G. BITUMINOUS-SAND DRAINAGE OF PEAT BOGS. (Rus) Moscow Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy. 37: 3-17. 1962. 292.9 M85

3498. Zaidel'man, F. R., and Zaks, V. G. REGULATION OF WATER OF FLOODED LANDS IN THE AREA OF SHALLOW GROUND WATER DEPOSITS. (Rus) Gidrotekh. i Melior. 10: 30-39. Oct. 1963. 290.8 G362

3499. Zubets, V. M. SOME EXPERIENCE IN THE RECLAMATION OF PEAT SOILS BY MEANS OF TILE DRAINAGE. (Rus) Gidrotekh. i Melior. 1960(7): 31-42. July 1960. 290.8 G362

3500. Zubets, V. M., and Murashko, A. I. SILT CONTROL IN BURIED PIPE DRAINAGE. (Rus) Gidrotekh. i Melior. 9: 21-32. Dept. 1962. 290.8 G362

3501. Zwerman, P. J. MOLE DRAINAGE CAN IMPROVE COMPACT SUBSOILS. Farm Res. [N.Y. Sta.] 22(1): 7. Jan. 1956. 100 N48A

An illustrated report was given on the use of mole drainage to improve compact subsoils in New York.

SEE ALSO--36, 45, 46, 65, 112, 123, 127, 145-147, 199, 337, 338, 408, 514, 581, 621, 730, 748, 769, 1004, 1009, 1052, 1076, 1130, 1150, 1205, 1249b, 1252, 1293, 1312, 1381, 1438, 1548, 1610, 1617, 1622-1624, 1632, 1636, 1650, 1653, 1655, 1656, 1658, 1662, 1663, 1665, 1666, 1669, 1671, 1677-1679, 1681, 1682, 1684, 1690-1692, 1695-1697, 1699, 1701, 1702, 1712, 1717, 1719, 1720, 1732, 1733, 1735, 1736, 1738, 1743, 1759, 1762-1764, 1776-1778, 1783, 1784, 1786, 1788a, 1801, 1805, 1812, 1815, 1828, 1830, 1831, 1842, 1844-1846, 1848, 1852, 1854, 1855, 1857, 1863, 1865-1867, 1872, 1881, 1882, 1884, 1889, 1890, 1894, 1896, 1897, 1900, 1901, 1905-1907, 1913, 1921, 1922, 1924-1926, 1945-1948, 1951, 1952, 1957, 1970-1973, 1975, 1978, 1979, 1981, 1987, 1988, 1990, 1991, 2002, 2003, 2008, 2012, 2016, 2019, 2021, 2022, 2031, 2032, 2036, 2040, 2047-2049, 2051, 2053, 2054, 2057, 2058, 2064, 2068-2070, 2083, 2088, 2094, 2097, 2113, 2115, 2122, 2123, 2129, 2133-2135, 2142, 2144, 2147, 2154, 2157-2159, 2163, 2174, 2176, 2189, 2191, 2192, 2194, 2201, 2206, 2208, 2211-2215, 2217-2219, 2231, 2235, 2237, 2238, 2246, 2249, 2253, 2258, 2264-2266, 2276, 2278, 2280, 2283, 2287, 2289, 2290, 2292, 2297, 2298, 2302, 2306-2308, 2314, 2315, 2321, 2324, 2329, 2331, 2334, 2338, 2340-2343, 2346, 2348, 2352, 2361, 2365, 2368, 2372-2375, 2377, 2378, 2383, 2386, 2388, 2392, 2399, 2403, 2404, 2408, 2409, 2411, 2412, 2415, 2420, 2434, 2435, 2447, 2475-2479, 2497, 2528, 2539, 2548, 2553, 2562, 2601, 2603, 2605, 2613, 2633, 2672, 2677, 2678, 2686, 2690, 2691, 2700, 2706, 2708, 2711, 2713, 2719, 2722, 2736, 2741, 2742, 2745, 2748, 2765-2767, 2773, 2795, 2840, 2854-2857, 2881, 2886, 2892, 2896, 2897, 2906, 2924, 2935, 2937, 2938, 2956, 2959, 2968, 2972, 3024, 3026, 3027, 3060, 3069, 3072, 3079, 3084, 3122, 3156, 3159, 3226, 3234, 3247, 3505, 3509, 3531, 3541,3542, 3577, 3594, 3601, 3625, 3640, 3641, 3649, 3651-3654, 3668, 3669, 3671, 3672, 3689, 3690, 3706, 3732, 3734, 3744, 3746, 3749, 3753, 3759, 3765, 3768, 3777, 3781, 3793-3795, 3811, 3814, 3820, 3822, 3825, 3836, 3840, 3847, 3848, 3864, 3874, 3876, 3877, 3879, 3886, 3899, 3913, 3915, 3924, 3930, 3941, 3942, 3945, 3954, 3963, 3964, 3968, 3969, 3997, 4003, 4005, 4012, 4016, 4020, 4023, 4024, 4027, 4030, 4033, 4034, 4037, 4042, 4053, 4055, 4056, 4061, 4062, 4068, 4075, 4076, 4078, 4085, 4091, 4092, 4098, 4101, 4105, 4114, 4122, 4128-4131, 4133, 4136, 4138, 4140, 4142-4144, 4149, 4152-4154, 4160, 4164-4167, 4171, 4172, 4182, 4185-4187, 4189, 4191, 4192, 4194, 4199, 4202-4206, 4217, 4218, 4221, 4222, 4225, 4225, 4227, 4232, 4235-4238, 4244, 4247, 4255, 4259-4261, 4266, 4271, 4272, 4275, 4283, 4286, 4289, 4294, 4295, 4297-4299, 4303-4305, 4311-4314, 4325, 4326, 4329, 4332-4334, 4336, 4340, 4344, 4345, 4349, 4352, 4359, 4361, 4367, 4372-4374, 4383, 4392, 4395, 4396, 4398, 4399, 4403, 4404, 4406, 4407, 4412, 4415, 4417, 4418, 4423, 4426-4428, 4433, 4434, 4441, 4443, 4446, 4449, 4451, 4452, 4455, 4458, 4460, 4465, 4467, 4472, 4483, 4484, 4497, 4498, 4515, 4516, 4528, 4536, 4543, 4569, 4594-4596, 4607, 4620, 4621, 4624, 4628, 4655, 4679, 4681, 4696, 4697, 4705, 4707, 4708, 4712-4714, 4724, 4732, 4734, 4739, 4743, 4744, 4748, 4759, 4761, 4774, 4777, 4778, 4790, 4813, 4829, 4840-4842, 4844, 4888, 4901, 4931, 4934, 4937, 4945, 4970, 4971, 4973, 4985, 4987, 4997, 5020, 5022, 5029, 5031, 5033, 5035, 5039, 5042b, 5065.

Pump Drainage and Wells

3502. Ahmad, N. CONTROL OF WATER-LOGGING AND SALINITY BY TUBE-WELL PUMPING. Pakistan J. Sci. 14(2): 49-62. Mar. 1962. 475 P172

A report was given on the need and use of tube well pumping to control waterlogging and salinity in West Pakistan.

3503. Ahmad, N. CONTROL OF WATER-LOGGING AND SALINITY BY TUBE WELL PUMPING, A CRITICAL REVIEW. Agr. Pakistan. 13(4): 1-14. map. Dec. 1962. 22 Ag832

A report was given of the control of waterlogging and salinity by tube well pumping in West Pakistan.

3504. American Society of Agricultural Engineers. Committee on Pump Drainage. SELECTED BIBLIOGRAPHY ON PUMP DRAINAGE. Trans. ASAE 3(1): 62, 64. 1960. 290.9 Am32T

A selected bibliography of 69 papers was presented on pump drainage.

3505. Asghar, A. G. RECLAMATION OF WATERLOGGED AND MARSHY LANDS IN WEST PAKISTAN. Cong. Irrig. and Drain. Trans. 4(3): 11.719-11.740. maps. 1960. 55.9 C7652

A report was given on the reclamation of waterlogged and marshy lands in West Pakistan by: Installation of drainage wells and pumps; construction of open drainage canals and ditches for removing surplus surface and shallow water; and installation of underground drains where needed.

3506. Begliarov, S. A., Gankin, M. Z., and Kondrat'ev, V. V. STANDARD PROJECTS FOR RECLAMATION PUMP STATIONS ON CANALS. (Rus) Gidrotekh. i Melior. 9(5): 23-32. May 1957. 290.8 G362

3507. Blidaru, A. ESTABLISHMENT OF TECHNICAL AND ECONOMIC INDICES FOR LARGE PUMPING STATIONS, CARRIED OUT IN THE COURSE OF THE LAST TEN YEARS IN THE R.P.R. (Rum) Jassy. Inst. Agron. "Ion Ionescu de la Brad." Lucrari Sti. 1962: 449-457. 1962. 106.4 J31L
French summary.

3508. Bolelli, E. PUMP DRAINAGE—FIRST RESULTS OF THE INVESTIGATION OF THE BENI AMIR—BENI MOUSSA (MOROCCO). (Fr) Internatl. Comn. Irrig. and Drain. Annu. B. 1957: 52-59. Ref. 1957. 55.9 In8A
English summary.

A report was given on the use of wells for drainage to lower the water table in an irrigated area in Morocco. The water from the wells were used for irrigation as the chemical quality was superior to the other water distributed by gravity.

3509. Bowler, D. G. SMALL-SCALE PUMPING SCHEMES FINAL SOLUTION TO OUTLET PROBLEM. New Zealand Meat Prod. 4(12): 39-40. Sept. 1960. 50.8 N48

A report was given on the use of pump drainage to solve some outlet problems in New Zealand.

3510. Clyma, W. ARTIFICAL GROUNDWATER RECHARGE BY A MULTIPLE-PURPOSE WELL. Tex. Agr. Expt. Sta. MP-712, 7 pp. 1964. 100 T31M

After a 1-hour pumping cycle, 89 to 93 percent of the clay that had entered a multiple-purpose well during the 24-hour recharge cycle was retained in the well. Recharging operations conducted for 3 years reduced the specific capacity of the well from 20 g.p.m. per foot of drawdown to g.p.m. per foot of drawdown. Efforts to redevelop the well using several different procedures increased the specific capacity of the well to 6.5 g.p.m. per foot of drawdown approximately 8 months after the low of 2 g.p.m. per foot of drawdown. The major improvement in yield came after surging caused the well to pump muddy water for several hours.

3511. Conkling, F. E. DRAINAGE AND WATER CONTROL. Sugar J. 24(7): 32. Dec. 1961. 65.8 Su391

A report was given on the system of drainage and water control of Lake Okeechobee in Florida. Nine drainage districts have been formed for the area. The area consists of 107,600 acres of land and there are 27 separate pumping plants. They have a combined capacity of over 3,600,000,000 gallons of water for a 24 hour period.

The works consist of levels, canals, and water control structure for drainage and flood control.

3512. Deguchi, K. RECLAMATION OF HACHIRO LAGOON IN JAPAN. Internatl. Comn. Irrig. and Drain. Annu. B. 1961: 103-106. map. 1961. 55.9 In8A

A report was given on the proposed reclamation of Hachiro Lagoon in Japan.

3513. Eremenko, G. V. REGIME OF PUMPING FROM WELLS OF VERTICAL DRAINAGE IN THE FERGANA VALLEY. (Rus) Gidrotekh. i Melior. 2: 19-25. Feb. 1964. 290.8 G362

3514. Garland, K. R., and Jones, G. O. RECLAMATION OF SALT-AFFECTED LAND-TEST AT KERANG. J. Agr. [Melbourne] 59(7): 327-329. July 1961. 23 V66J

A report was given on the use of wells for irrigation for the reclamation of salt affected land in Australia and lowering of the water table.

3515. Glover, R. E., and Bittinger, M. W. DRAWDOWN DUE TO PUMPING FROM AN UNCONFINED AQUIFER. Amer. Soc. Civil Engin. Trans. 126(3): 176-183. 1961. 290.9 Am3

First approximation treatments of the drawdown pattern about a pumped well in an unconfined aquifer were commonly based upon the simplifying assumption that the drawdown does not alter the transmissibility of the aquifer. A second approximation was reported which accounts for the reduction of the transmissibility by the drawdown.

3516. Goto, S., Igaki, C., Kobayashi, J., and Ishida, Y. STUDIES ON IMPROVEMENT OF THE DAMP RICE-FIELDS IN SASAYAMA BASIN. IV. MELIORATION EFFECTS ON A DAMP RICE-FIELD UNDER THE CONTROL OF THE GROUND WATER LEVEL. (Ja) Hyogo U. Agr. Sci. Rpt. Ser. Agr. 3(2): 117-123. Dec. 1958. 22.5 H992

A report was given on the use of a shallow well for both drainage and irrigation of a rice field in Japan.

3517. Grebennikov, V. N. SOME EXPERIENCE IN CONSTRUCTION AND OPERATION OF VERTICAL DRAINAGE HOLES WITH HIGH DISCHARGES IN THE GOLODNAYA STEP. (Rus) Gidrotekh. i Melior. 1961(10): 28-36. Oct. 1961. 290.8 G362

3518. Haldre, H. WATER SCREW AS A LOW-PRESSURE PUMPING DEVICE. (Es) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov. 22: 8-14. 1961. 106 Es83
English summary.

A report was given on the use of the water screw for pump drainage in Estonis where the pressure is very low and ordinary pumps are not effective.

3519. Hantush, M. S. DRAINAGE WELLS IN LEAKY WATER-TABLE AQUIFERS. J. Hydraul. Div., ASCE 88(HY 2): 123-137. Mar. 1962. 290.9 Am3Ps

Flow formulas were found for a well draining a water-table aquifer that overlies a semipervious layer through which leakage takes place from or into an underlying permeable strata in which the hydraulic head remains uniform. The leaky water-table aquifer was replenished by vertical percolation due to excess irrigation or leaching or both. A function depending on two parameters was tabulated in order to simplify calculations leading to the determination of the appropriate well discharge and spacing. An expression for the time required to lower the water table to a new desirable elevation was obtained.

3520. Hantush, M. S. HYDRAULICS OF GRAVITY WELLS IN SLOPING SANDS. J. Hydraul. Div., ASCE 88(HY 4): 1-17. July 1962. 290.9 Am3Ps

An approximate partial differential equation was developed for the flow of ground water through a water table aquifer resting on a sloping impermeable bed. The equation was integrated to obtain analytical expressions for the draw-down distribution around wells completely penetrating the water-bearing medium. The aquifer may be infinite in area or it may be bounded on one side by a fairly straight and effectively long section of a stream that cuts completely through the aquifer. The well may be operating at a constant head or at a constant discharge. The solutions were presented in forms amenable to relatively simple computation. The results were compared with those of a horizontally laid water-bearing medium.

3521. Hantush, M. S. DRAWDOWN AROUND A PARTIALLY PENETRATING WELL. Amer. Soc. Civil Engin. Trans. 127(1): 268-283. 1962. 290.9 Am3

Equations of unsteady drawdown around a well partially screened in and steadily discharging from an artesian aquifer of uniform thickness and iniform hydraulic properties were developed. The discharge is supplied by the reduction of storage through expansion of water and the concomitant compression of the aquifer. The solutions are put in forms amenable to relatively simple computation. The results were compared with that of the case of complete penetration.

3522. Hantush, M. S. AQUIFER TESTS ON PARTIALLY PENETRATING WELL. Amer. Soc. Civil Engin. Trans. 127(1): 284-308. 1962. 290.9 Am3

The theory of nonsteady flow toward artesian wells partially penetrating infinite nonleaky aquifers was used to outline methods for the determination of the formation coefficients as well as the thickness of the water-bearing formation. Applications of these methods were illustrated by analyzing data from ground-water basins in New Mexico.

3523. Hantush, M. S. HYDRAULICS OF GRAVITY WELLS IN SLOPING SANDS. Amer. Soc. Civil Engin. Trans. 128(1): 1423-1437. 1963. 290.9 Am3

An approximate partial differential equation was developed for the flow of ground water through a water-table aquifer resting on a sloping impermeable bed. The equation was integrated to obtain analytical expressions for the draw-down distribution around wells completely penetrating the water-bearing medium. The aquifer may be infinite in area or it may be bounded on one side by a fairly straight and effectively long section of a stream that cuts completely through the aquifer. The well may be operating at a constant head or a a constant discharge. The solutions were presented in forms amenable to relatively simple computation. The results were compared with those of a horizontally laid water-bearing medium.
With discussion by Messrs. Paul Baumann; and Mahdi S. Hantush. pp. 1438-1442.

3524. Hantush, M. S. HYDRAULICS OF WELLS. In Chow, V. T., ed. ADVANCES IN HYDROSCIENCE I. Academic Press, N.Y. pp. 281-442. Ref. 1964. 292.8 Ad9

A detailed report was given on the hydraulics of wells that included drainage wells.

3525. Hantush, M. S. DEPLETION OF STORAGE, LEAKAGE, AND RIVER FLOW BY GRAVITY WELLS IN SLOPING SANDS. J. Geophysical Res. 69(12): 2551-2560. 1964. 470 J823

Formulas were obtained for estimating the rate, at any time after pumping begins, and the total volume, at the end of a period of continuous pumping, of the parts of the well yield that were derived from storage, induced leakage, and induced infiltration from the river and/or from the natural flow that would have discharged into the river if the well had not been pumping. It was assumed that the river cuts completely through the sand and flows in a fairly straight course which extends a considerable distance on both sides from the well location. Two cases were considered: A stream cutting across the natural flow; and a stream cutting along the natural flow.

3526. Hantush, M. S. DRAWDOWN AROUND WELLS OF VARIABLE DISCHARGE. J. Geophysical Res. 69(20): 421-4235. Ref. Oct. 15, 1964. 470 J823

Drawdown formulas were obtained for wells operating in leaky or nonleaky effectively infinite aquifers, having three types of probable discharge-time variation. These formulas were expressed either in terms of already known and extensively tabulated functions or in terms of functions that can easily be tabulated for practical ranges of the parameters involved. Use of these formulas in the analysis of pumping-test data was discussed.

3527. Hantush, M. S., and Jacob, C. E. NONSTEADY RADIAL FLOW IN AN INFINITE LEAKY AQUIFER. Amer. Geophysical Union Trans. 36: 95-100. 1955. 330.9 Am3

The nonsteady drawdown distribution near a well discharging from an infinite leaky aquifer was presented. Variation of drawdown with time and distance caused by a well of constant discharge in confined sand of uniform thickness and uniform permeability was obtained. The discharge is supplied by the reduction of storage through expansion of the water and the concomitant compression of the sand, and also by leakage through the confining bed. The leakage was assumed to be at a rate proportional to the drawdown at any point. Storage of water in the confining bed was neglected. Two forms of the solution were developed. One is suitable for computation for large values of time and the other suitable for small values of time. This solution was compared with earlier solutions for slightly different boundary conditions.

3528. Hantush, M. S., and Jacob, C. E. NON-STEADY GREEN'S FUNCTIONS FOR AN INFINITE STRIP OF LEAKY AQUIFER. Amer. Geophysical Union Trans. 36: 101-112. 1955. 330.9 Am3

Solutions were obtained for the nonsteady flow to a well in an infinite-strip of leaky aquifer whose boundaries are maintained either at a constant head or at a vanishing flux. These solutions were used to deduce the corresponding solutions for nonleaky aquifers. Also they were used to obtain the nonsteady Green's functions for the infinite-strips. Green's functions were tabulated for infinite quadrants and half-planes.

3529. Hantush, M. S., and Jacob, C. E. STEADY THREE-DIMENSIONAL FLOW TO A WELL IN A TWO-LAYERED AQUIFER. Amer. Geophysical Union Trans. 36: 286-292. 1955. 330.9 Am3

In part I, a solution was obtained for the potential distribution induced by a well screened in uniform sand and pumping from it at a constant rate. This sand is overlain by another sand of different permeability, over whose upper surface the potential is uniform. The potential remains constant also at the common outer boundary of both sands which is concentric with the well. A sample calculation was made for an assumed set of the parameters of the system. For all practical values of the parameters in leaky aquifers, the validity of earlier assumptions made to reduce three-dimensional problems to two dimensions was verified.

In part II, the solution obtained was for the case where the steadily discharging well is screened in the upper of the two sands. Here, the two layers of sand are bounded above and beneath by impervious strata. The other boundary conditions are the same as those stipulated for the problem described in part I.

3530. Hantush, M. S., and Papadopulos, I. S. FLOW OF GROUND WATER TO COLLECTOR WELLS. J. Hydraul. Div., ASCE 88(HY 5): 221-244. Sept. 1962. 290.9 Am3Ps

Analytical solutions for the drawdown distribution around collector wells steadily discharging from homogeneous confined and unconfined aquifers of uniform hydraulic properties were presented. It was assumed that the aquifer is horizontal and uniform in thickness; the radius of each of the laterals of the collector well is small compared to the thickness of the aquifer;

the radius of the caisson is small compared to the length of the lateral; and the yield of each of the laterals is uniformly distributed along its length. Relatively simple equations for the yield of collector wells located near, or under, stream channels also were obtained. Drawdown distributions around collector wells of symmetrically located laterals in a relatively thick aquifer were graphically illustrated. Profiles of drawdown induced by collector wells in completely penetrating observation wells were shown.

3531. Harrison, D. S. WATER TABLE FLUCTUATIONS IN ORGANIC SOILS OF SOUTH FLORIDA DURING PERIODS OF DRAINAGE AND IRRIGATION. Soil and Crop Sci. Soc. Fla. Proc. 19: 352-356. 1959. 56.9 So32

A report was given on observed water table fluctuation in organic soils of south Florida during periods of drainage and irrigation.

3532. Hernandez-Agosto, M. A. FROM SWAMPS TO SUGAR CANE. Sugar J. 24(2): 60-62. July 1961. 65.8 Su391

A report was given of reclamation and drainage projects in Puerto Rico for sugarcane production in former swamp lands.

3533. Himbeeck, C. Van. THE STUDY OF THE CONSTRUCTION OF A DRAINAGE SYSTEM OR POLDER AND A PUMPING PLANT. (Fl) Agricultura [Louvain] (ser. 2) 6(2): 379-398. June 1958. 13 R32 English summary.

The results of a study on watershed drainage by pumping was given for a polder in Belgium.

3534. Irwin, R. W. DITCH STORAGE FOR FARM DRAINAGE PUMPING PLANTS. Agr. Engin. 44(10): 548-549, 551. Ref. Oct. 1963. 58.8 Ag83

A discussion was given of ditch storage for farm drainage pumping systems.

3535. Kadrevich, T. A. DRAINAGE OF MARSH LANDS IN THE COASTAL ZONE OF THE LATVIAN SSR BY PUMPING. (Rus) Gidrotekh. i Melior. 9(3): 28-38. Mar. 1957. 290.8 G362

3536. Kalisvaart, C. SUBIRRIGATION IN THE ZUIDERZEE POLDERS. Internatl. Inst. Land Reclam. and Impr. P. 2, 55 pp. 1958. 54.9 In8

A report was given on the use of irrigation and drainage on the Zuiderzee polders in the Netherlands which are situated down to 5 meters (16 feet) below sea level. Drainage is done by pumping into a closed dam area (Yssel Lake) which has become fresh water. This water can be used for irrigation on the drought sensitative soils by subirrigation or drainage in reverse.

3537. Kaneko, R., and Sasaki, S. LAND IMPROVEMENT PROJECT ON THE LOWER SHINANO RIVER. Cong. Irrig. and Drain. Trans. 3(5): 10.159-10.173. maps. 1957. 55.9 C7652

A report was given on the pumping stations and drainage works in this area of Japan constructed in the last 300 years.

3538. Kaplinskii, M. I. UTILIZATION OF UNDERGROUND WATER FOR IRRIGATION. (Rus) Gidrotekh. i Melior. 10: 3-15. Oct. 1962. 290.8 G362

3539. Klimko, A. I. THE USE OF VACUUM PUMPS IN THE DRAINAGE. (Rus) Gidrotekh. i Melior. 12: 39-43. Dec. 1964. 290.8 G362

3540. Klingelhofer, K. R. FARM DRAINAGE BY PUMPING. Agr. Engin. 39: 754-757. 1958. 55.8 Ag83

There are many acres of wet but potentially good cropland in Michigan that are not fully utilized for lack of good natural, gravity drainage outlets. Some of the acreage has not been farmed recently; some has been left undrained for various reasons and in other areas recent drainage improvements have been limited. It was estimated that there are approximately 400 pumping plants in operation draining 45,000 acres, of which 12,500 acres are drained by two plants. Approximately one-third of the total area requires only pumping of tile drainage water. The other two-thirds requires pumping of both tile and surface water.

3541. Larson, C. L. FIVE YEARS OF PUMP DRAINAGE. Land Impr. 5(4): 18-19. Apr. 1958. 282.8 L224

A report was given of the value of pump drainage for drain tile areas with unsuitable outlets. Installation and operation costs of these systems were given for 5 years of records in Minnesota (1953-57). Details for standby pumping plants were given along with automatic pumping plant systems.

3542. Larson, C. L. PUMPING PLANTS ARE PROVING THEIR WORTH AS TILE OUTLETS. Minn. Farm and Home Sci. 16(3): 9, 11, 17. May 1959. 100 M668

A report was given on the economics of use of pumping plants for tile outlets in Minnesota.

3543. Lehr, J. H. MODEL ANALYSIS OF WATER TABLE DRAWDOWN SURROUNDING PUMPING WELLS. J. Soil and Water Conserv. 18: 205-207. 1963. 56.8 J822

The effects on the water table level of pumping and artificial recharge of underground aquifers were given. The basic principles discussed have significant implications for all users of underground water.

3544. Lely, G. Van Der. THE PROBLEM OF OPTIMUM POINT OF REPLACEMENT IN REPLACEMENT AND JOINING OF PUMPING EQUIPMENT. (Du) Landbk. Tijdschr. 74(21): 904-911. map. Dec. 1962. 105.2 Or3

3545. Liu, C. M. ELECTRIFIED DRAINAGE AND IRRIGATION. China Reconstr. 11(5): 36-38. May 1962. 280.8 C447

A report was given on the use of electricity for drainage and irrigation projects in China. Pump drainage is used to drain the land after flooding.

3546. Luthin, J. N., and Scott, V. H. DRAINAGE ADJACENT TO A RIVER. Calif. Agr. 11(4): 34, 36. Apr. 1957. 100 C12Cag

Investigations were reported on the use of pumped wells for field drainage of river seepage in California.

3547. Meyer, J. L., Werenfels, L., Scott, V. H., Luthin, J. N., and Abu-Zied, M. DRAINAGE BY PUMPED WELLS. Calif. Agr. 16(8): 10-12. Aug. 1962. 100 C12Cag

A report was given of the use of pump wells for drainage in California.

3548. Milligan, C. H. PUMPING GROUND WATER FOR IRRIGATION AND DRAINAGE. Amer. Soc. Civil Engin. Trans. 122: 228-234. 1957. 290.9 Am3

Ground water is an important but neglected national resource. Existing developments illustrate the need for planned utilization of ground water which produces both irrigation and drainage benefits. Physical data, legal concepts, and administrative principles and practices must be improved and developed to stimulate and guide sound ground-water development.

3549. Milojevic, M. RADIAL COLLECTOR WELLS ADJACENT TO THE RIVER BANK. Amer. Soc. Civil Engin. Trans. 129: 786-788. 1964. 290.9 Am3

A digest was given of an article and closure written on experimental model investigations on radial collector wells adjacent to the river bank in Yugoslavia. The original paper was published in the J. Hydraul. Div., ASCE 89(HY 6): 133-151, Nov., 1963 and the closure in 90(HY 4): 329, July, 1964.

3550. Minaev, I. V. ECONOMIC DISTRIBUTION OF PUMPING WELLS IN VERTICAL DRAINAGE. (Rus) Gidrotekh. i Melior. 10(10): 24-30. Oct. 1958. 290.8 G362

3551. Monhemius, L., and Rossum, H. Van. POLDER PUMPING ENGINES. (Du) Landbk. Tijdschr. 73(15): 726-743. Ref. Sept. 1961. 105.2 Or3

3552. Morooka, M., and Kobayashi, H. THE ARCHITECTURE OF A ROUND PLASTIC PUMPING STATION. (Ja) Nogyodoboku-Kenkyu. 30(5): 1-6. Jan. 1963. 290.8 N68

3553. Oganezon, G. PUMP DRAINAGE FROM WELLS USED ON LANDS OF NORTHERN STEPPE. (Rus) Erevan, Armianskoe gos. izd-vo, 104 pp. 1956. 54 Og1

3554. Omelin, N. N. SELECTION OF PUMPS FOR VERTICAL DRAINAGE. (Rus) Gidrotekh. i Melior. 1960(1): 36-38. Jan. 1960. 290.8 G362

3555. Ostendorf, F. W. DRAINAGE OF THE "CULTUURTUIN" [ECONOMIC GARDENS] POLDER BY PUMPING. (Du) Surinaamse Landbk. 5(3): 130-142. May/June 1957. 9.6 Su7
English summary.

The results of drainage of the Economic Gardens polder by pumping were given. Records showed the daily number of working hours for the pump along with monthly rainfall figures. An equation was given to show how much water had to be pumped during periods of heavy rainfall.

3556. Pankov, P. I. THE APPLICATION OF A MECHANICAL RAISING OF THE WATER LEVEL IN THE DRAINING OF LAND. (Rus) Vest. Sel'skokhoz. Nauki. 1960(10): 106-109. Oct. 1960. 20 V633 English summary.

A report was given on the value of drainage by pumping in the U.S.S.R.

3557. Pankov, P. I. EXPENDITURES FOR MECHANICAL LIFTING OF WATER IN DRAINAGE. (Rus) Moscow. Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy. 37: 121-133. 1962. 292.9 M85

3558. Pankov, P. I., and Saborskii, O. V. AUTOMATION AND CONTROL OF PUMPING STATIONS IN THE SLAVSK DRAINAGE SYSTEM (KALININGRAD REGION). (Rus) Gidrotekh. i Melior. 1960(1): 19-23. Jan. 1960. 290.8 G362

3559. Petersen, J. S., Rohwer, C., and Albertson, M. L. EFFECT OF WELL SCREENS ON FLOW INTO WELLS. Amer. Soc. Civil Engin. Trans. 120: 563-585. 1955. 290.9 Am3

The hydraulics of wells involves the following flow: (1):In the surrounding aquifer; (2) through the well screen; and (3) inside the well. This paper is concerned with the flow through the screen and inside the well. A theoretical development was presented which relates the loss of head to the characteristics of the well screen. To support the theoretical development, a laboratory investigation of well screens was made.

With Discussion by Messrs. Wen-Hsiung Li; Arthur L. Collins; Mohammad Nazir and Nazir Ahmad; Matthew I. Rorabaugh; Dean F. Peterson, Jr.; G. Cohen De Lara; Gerard Tison, Jr.; and Jack S. Petersen, Carl Rohwer, and Maurice L. Albertson. pp. 586-607.

3560. Peterson, D. F., Jr. INTERCEPTING DRAINAGE WELLS IN ARTESIAN AQUIFER. J. Irrig. and Drain. Div., ASCE 87(IR 1): 7-14. Mar. 1961. 290.9 Am3Ps

A formula for channel seepage to a leaky artesian aquifer and for the resulting piezometric surface was presented. A potential function accounting for excess irrigation and leaching water applied to agricultural lands was proposed. Using this function in combination with conventional well potential theory, a method for designing intercepting drainage wells for such an aquifer underlying irrigated lands was described.

3561. Peterson, D. F., Jr. HYDRAULICS OF WELLS. Amer. Soc. Civil Engin. Trans. 122: 502-517. 1957. 290.9 Am3

The development of theoretical well hydraulics and certain aspects of the application of these developments to practical problems were reviewed. Considerable information is available regarding the hydraulics of well components and hydrodynamic details existing near the well. Much research is needed, however, for a better understanding of the hydrodynamic conditions near and through the well and for relating such information to natural geologic conditions and practical well engineering.

3562. Puls, G. DRAINAGE ON THE ARLAU REGION. FLOOD RELIEF AND PUMPING STATION OF ARLAU. (Ge) Wasser u. Boden. 9(5): 159-160. May 1957. 56.8 W28

3563. Rigby, W. LAND DRAINAGE PUMPING STATIONS IN ENGLAND. Cong. Irrig. and Drain. Trans. 3(5): C.97-C.112. map. 1957. 55.9 C7652

A report was given on land drainage pumping stations in England where the land lays below sea level. Typical installations of pumping machinery used in the area were described and illustrated.

3564. Rustamov, G. G. FOR HIGHER EFFICIENCY OF OPEN DRAINAGE ON IRRIGATION LANDS. (Rus) Gidrotekh. i Melior. 10: 23-30. Oct. 1962. 290.8 G362

3565. Sadykov, G. K. WIND-DRIVEN WATER PUMPS FOR KAZAKH PASTURES. (Rus) Sel'khozmashina. 5: 6-11. May 1956. 58.8 Se42

3566. Sanderson, R. A., and Klingelhofer, K. R. FARM DRAINAGE BY PUMPING. Agr. Engin. 39(12): 754-757, 766. map. Dec. 1958. 58.8 Ag83

An engineering survey of typical drainage pumping installations in Michigan was given along with a discussion of the growth of the practice.

3567. Scott, D. F. DRAINAGE BY PUMPING. New Zealand J. Agr. 95(1): 73-75, 77, 79-81. July 15, 1957. 23 N48J

Most land drainage systems in New Zealand depend on gravity for their outlet, but sometimes any of the following factors can make it necessary to use pumping: Drainage into a tidal estuary; drainage into a stream of river subject to flooding; situations where the outlet is through a drain or drains not well maintained; and drainage of low-lying, flat areas where the required depth of outlet is lower than that available.

Types of pumps and management of the pumps were described and illustrated.

3568. Shahroody, A. M., and Davis, J. R. EFFICIENCY OF PUMPING FROM SMALL CIRCULAR SUMPS. J. Irrig. and Drain. Div., ASCE 90(IR I): 1-8. Mar. 1964. 290.9 Am3Ps

Recent emphasis on the recovery of irrigation tailwater in the United States has resulted in an increased use of pumped sumps as an integral part of irrigation systems. Sumps are also widely used in agricultural drainage systems and in many municipal and industrial supply and disposal systems.

Efficiency and minimum safe submergence of a 4-in. vertical turbine tailwater recovery pump in a circular pump were affected by side clearance and inflow velocity, but not by bottom clearance. Highest pump efficiency was attained in laboratory tests with a bottom clearance of either 0.5 D, D, or 2 D; a side clearance of 2 D or greater; and an inflow velocity of 1 f.p.s. where D represents the inside of the suction bell, in inches. Minimum safe submergence of approximately 9 D was required to avoid vortex formation; however, lowest values of minimum safe submergence were observed at small side clearances.

3569. Sutton, J. G. THE USE OF PUMPS FOR DRAINAGE. U.S. Dept. Agr., Ybk. Agr. 1955: 528-538. 1955. 1 Ag84Y

A discussion was given of the use of pumps for drainage in the United States and the Netherlands.

3570. Sutton, J. G. THE USE OF PUMPS FOR DRAINAGE. Australia. Irrig. and Pasture Impr. 4(7): 12-16, 27-31. June 1959. 55.8 Au7

A report was given of the use of pumps for drainage in the United States.

3571. U.S. Soil Conservation Service. Engineering Division. FARM DRAINAGE PUMPING PLANTS. 30 pp. [Washington, 1954] A290 So323

A report was given on the need, design, and use of farm drainage pumping plants in the United States.

3572. U.S. Soil Conservation Service. Engineering and Watershed Planning Unit. GUIDE FOR DRAINAGE OF SMALL FARM AREAS BY PUMPING. U.S. Soil Conserv. Serv. Engin. and Watershed Planning Unit. Tech. Release, EWP 7, 16 pp. Jan. 1963. A290.9 So33

A guide was given for drainage of small farm areas by pumping.

3573. U.S. Soil Conservation Service. Engineering and Watershed Planning Unit. TIDES AND TIDAL DRAINAGE IN THE NORTHEASTERN STATES. U.S. Soil Conserv. Serv. Engin. and Watershed Planning Unit. Tech. Release, EWP 6, 20 pp. Jan. 1963. A290.9 So33

A guide was given on tides and tidal drainage in the Northeastern United States by dikes and/or pumping systems.

3574. Velicu, L. FEATURES CONCERNING THE INFLUENCE UPON THE OUTPUT OF REEDS OF THE PUMP DRAINAGE OPERATED UPON THE MALIUC AND RUSCA DAM ENCLOSED AREAS. (Rum) Celuloza si Hirtie. 10(4): 105-109. map. Apr. 1961. 309.8 C334
English summary.

A report was given on the advantages of pump drainage on reed peat land in Rumania.

3575. Volkov, R. I. OPERATION REGIME OF DRAINAGE PUMPING STATIONS AND METHODS FOR ITS IMPROVEMENT. (Rus) Gidrotekh. i Melior. 1: 39-47. Jan. 1963. 290.8 G362

3576. Walton, W. C., and Walker, W. H. EVALUATING WELLS AND AQUIFERS BY ANALYTICAL METHODS. J. Geophysical Res. 66: 3359-3370. 1961. 470 J823

The practical application of available analytical methods to ground water resource management problems in Illinois was described. The actual ground water condition was simulated by a model aquifer having straight-line boundaries, an effective width, length, and thickness, and sometimes a confining bed with an effective thickness.

3577. Welker, C. H. SEEPAGE PROBLEMS IN WEST PAKISTAN. In PROCEEDINGS SEEPAGE SYMPOSIUM PHOENIX, ARIZONA, 1963. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 31-38. map. Jan. 1965. A56.9 R31

A discussion was given on seepage problems and recommended control for reclamation projects in West Pakistan where most of the seepage comes from unlined canals. Deep gravel-packed wells with high capacity turbine pumps generally were the cheapest and easiest means to reduce the high ground water table.

3578. Wilson, T. V., Snell, A. W. SHALLOW GROUNDWATER FOR IRRIGATION. Clemson U. Agr. Res. 10(1): 15. 1964. 100 So850

Shallow ground water can be obtained by excavating a pit, or by installing shallow well points, each of which should extend to a depth below the water table in order to intercept "free" water in the soil.

3579. Zollner, E. ECONOMIC MANAGEMENT OF PUMPING STATIONS. (Ge) Wasser u. Boden. 9(5): 154-156. May 1957. 56.8 W28

3580. Zollner, E. DRAINAGE OF MARSHES WITH PUMPING STATIONS. (Ge) Wasser u. Boden. 10(12): 367-369. Dec. 1958. 56.8 W28

SEE ALSO--788, 1198, 1283, 1381, 1407, 1429, 1580, 1584, 1597, 1600, 1650, 1662, 1698, 1720, 1738, 1746, 1758, 1759, 1774, 1801, 1873, 1874, 1875, 1877, 1883, 1906, 1922, 1926, 1965, 1971, 1972, 1987, 2008, 2011, 2012, 2028, 2051, 2063, 2064, 2105, 2120, 2132, 2150, 2151, 2157, 2163, 2183, 2225, 2261, 2329, 2334, 2346, 2376, 2413, 2415, 2478, 2715, 2968, 3026, 3029, 3403, 3430, 3594, 3601, 3676, 3689, 3723, 3739, 3760, 3827, 3830, 3862, 3893, 3930, 4003, 4024, 4027, 4042, 4247, 4338, 4934, 4937, 5031, 5039, 5065, 5083.

Drainage of Irrigated Lands and Drainage for Salinity Control

3581. Abduev, M. EXPERIMENTAL WATERING OF SALINE SOILS OF RECENT ORIGIN ON THE AZERBAIJAN PLAIN. (Rus) Khlopkovodstvo. 1959(12): 39-43. Dec. 1959. 72.8 K522

3582. Abduev, M. R. DYNAMICS OF SALINE PLOTS ON THE MIL'SKAYA STEPPE. (Az) Akad. Nauk Azerb. SSR. Izv. Ser. Biol. i Med. Nauk. 1962(1): 77-82. 1962. 442.9 Ak132 Russian summary.

3583. Abduev, M. R. INCREASE OF ALKALINITY FOLLOWING SOIL LEACHING AND ITS CONTROL. (Rus) Khlopkovodstvo. 12: 46-48. Dec. 1964. 72.8 K522

3584. Abduragimov, T. A. STUDY OF LEACHING EFFECT OF THE HORIZONTAL DRAINAGE, WITH THE APPLICATION OF RADIO-ACTIVE TRACERS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 87: 119-126. Ref. 1963. 20 M857

3585. Abell, L. F., and Gelderman, W. J. ANNOTATED BIBLIOGRAPHY ON RECLAMATION AND IMPROVEMENT OF SALINE AND ALKALI SOILS (1957-1964). Int. Inst. Land Reclam. Impr. Bibliog. 4, 59 pp. Ref. 1964. 241 In825

An annotated bibliography was given for the period 1957-64 on reclamation and improvement of saline and alkali soils.

3586. Acevedo-Ramos, G., Bonnet, J. A., and Ortiz-Valez, J. DEGREE OF RECLAMATION OF A SALINE-SODIC SOIL IN LAJAS VALLEY, PUERTO RICO. Puerto Rico U. J. Agr. 45(3): 157-171. July 1961. 8 P832J

A report was given in the reclamation of saline-sodic soils in southwestern Puerto Rico. Preliminary results were given of a field experiment testing the effects of bagasse, bagasse + calcium chloride, sulfur, bagasse + sulfur, and two checks, when the areas were flooded periodically with fresh water.

3587. Adair, C. R., Miller, M. D., and Beachell, H. M. RICE IMPROVEMENT AND CULTURE IN THE UNITED STATES. Adv. Agron. 14: 61-108. Ref. 1962. 30 Ad9

A review of the literature and a discussion were given on rice improvement and culture in the United States. The need and use of irrigation and drainage were included in the discussion.

3588. Addison, H. LAND, WATER, AND FOOD; A TOPICAL COMMENTARY ON THE PAST, PRESENT, AND FUTURE OF IRRIGATION, LAND RECLAMATION, AND THE FOOD SUPPLIES THEY YIELD. Ed. 2. rev. and enl. London, Chapman and Hall, 284 pp. maps. Ref. 1961. 54 Ad2

A commentary was given in this book on the past, present, and future of irrigation, land reclamation, and food throughout the world. The need and use of drainage was also discussed briefly for some of the areas.

3589. Agaev, B. M. RECLAMATION OF LANDS WITH SODA-SALINIZATION IN THE KARABAKH STEPPE. (Rus) Khlopkovodstvo. 1960(11): 59-61. Nov. 1960. 72.8 K522

3590. Agafonova, A. F. PROCEDURES ON CARRYING OUT EXPERIMENTAL WORKS IN MELIORATION OF SOLONETZ AND HIGHLY SALINE SOILS FOR SHELTERBELTS. (Rus) In ZASHCHITNOE LESORAZVEDENIE NA ZHELEZNYKH DOROGAKH. Moskva, Gosudarstvennoe Transportnoe Zheleznodorozhnoe Izdatel'stvo, pp. 49-63. Ref. 1957. 99.45 Z13

3591. Agarwal, R. R. ALKALI SOILS CAN BE RECLAIMED. Indian Farming. 7(9): 6-8. Dec. 1957. 22 In283

A report was given on the reclamation of alkali soils for rice in India by gypsum or gypsum plus a green manure crop.

3592. Agarwal, R. R., Mehrotra, C. L., and Gupta, C. P. SPREAD AND INTENSITY OF SOIL ALKALINITY WITH CANAL IRRIGATION IN GANGETIC ALLUVIUM OF UTTAR PRADESH. Indian J. Agr. Sci. 27(4): 363-373. Dec. 1957. 22 Ag831

A study was reported of the spread of soil alkalinity from canal irrigation in India.

The quality of irrigation water was the most important factor that caused the soil salinization, but the following soil factors were very important: Soil minerals, subsoil compaction, drainage, permeability of the entire soil strata, and soil management practices.

After 40 years, the soil salinization had increased in 9 out of 12 fields.

3593. Aglibut, A. P., Valbuena, F. L., and Caoili, A. A. IRRIGATION AND DRAINAGE IN LOWLAND RICE PRODUCTION. Philippine Agr. 44(6): 271-278. Ref. Nov. 1960. 25 P542

A discussion was given on the need and use of irrigation and drainage in lowland rice production in the Philippines.

3594. Ahmad, N. SOIL SALINITY IN WEST PAKISTAN AND MEANS TO DEAL WITH IT. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 117-125. Ref. 1961. 278.9 Un3

A discussion was given of the causes of soil salinity problems in West Pakistan and the following ways used to reduce it: (1) Removal of salts by leaching; (2) open drains; (3) tile drains; (4) and drainage by pumping.

3595. Ahuja, P. R., and Sainani, R. H. WATERLOGGING PROBLEMS AND THE REMEDIES. Cong. Irrig. and Drain. Trans. 4(3): 11.529-11.548. 1960. 55.9 C7652

A report was given on the problem of waterlogging in irrigated areas of India. The remedies used to correct these problems were discussed. Additional measures were given to reclaim large waterlogged areas in the country to make them productive.

3596. Akhmedov, A. A. PRESSING PROBLEMS OF RECLAMATION OF IRRIGATED LANDS IN TAKZHIK SSR. (Rus) Gidrotekh. i Melior. 8(10): 19-26. Oct. 1956. 290.8 G362

3597. Akhundov, A. K., and Teimurov, K. G. RESULTS OF WORKS ON WASHING OUT HEAVY SOILS SALINIZED BY SODIUM SULPHATE. (Rus) Pochvovedenie. 1960(5): 112-113. May 1960. 57.8 P34 English translation—Soviet Soil Sci. 5: 556-557. May 1960. 57.8 P34Ae

A report was given on the need of leaching heavy soils salinized by sodium sulphate in cold climates in the spring and summer to avoid the accumulation of mirabilite that precipitates out if done in the winter in these areas.

3598. Albescu, I., and Vogios, K. PRODUCTION OF RICE ON SALTY SOILS. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 4: 25-29. 1963. 20 M57

3599. Aljibury, F. K. IRRIGATION AND LEACHING. Calif. Citrog. 49(12): 456. Oct. 1964. 80 C125

A report was given on irrigation and leaching requirements of citrus orchards in California.

3600. Allison, L. E. SALINITY IN RELATION TO IRRIGATION. In ADVANCES IN AGRONOMY. 16: 139-180. Ref. 1964. 30 Ad9

A review of the literature and a discussion were given of the effects of salinity in relation to irrigation in the following chapters: (1) Introduction; (2) salinity of irrigation waters; (3) effect of salt on soils; (4) effect of salt on crops; (5) reclamation of salt affected land; and (6) conclusions.

3601. Allison, U. S. THE PRACTICE OF CONTROLLED DRAINAGE IN FLORIDA. (Abs.) Assoc. Southern Agr. Workers Proc. 53: 27-28. 1956. 4 C82

A report was given on controlled drainage in Florida. The author concluded that a controlled drainage system, properly planned, operated, and maintained, will provide water table control and prove equally valuable as a drainage system during rainy seasons and an irrigation system during dry seasons.

3602. Almeida, A. A. F. De. RECOVERY OF SALTED SOILS. (Por) Gaz. Agr. de Angola. 7(8): 500-501. Feb. 1963. 24 G252

3603. Amemiya, M., and Robinson, C. W. THE USE OF UNDISTURBED SOIL CORES TO INVESTIGATE THE RECLAMATION OF SALINE AND ALKALINE SOILS. Soil Sci. Soc. Amer. Proc. 22(1): 76-78. Ref. Jan./Feb. 1958. 56.9 So3

A report was given on the comparison of use of undisturbed soil cores with field studies to investigate the reclamation of saline and alkaline soils.

3604. Amemiya, M., Robinson, C. W., and Cowley, E. W. RECLAMATION OF A SALINE-ALKALI SOIL IN THE UPPER COLORADO RIVER BASIN. Soil Sci. Soc. Amer. Proc. 20: 423-426. Ref. July 1956. 56.9 So3

The feasibility was studied of reclaiming an unproductive saline-alkali soil (Billings silty clay loam) near Grand Junction, Colo. The effects of leaching and gypsum on the reclamation of this soil were followed by periodic soil analysis and by measuring the yield of alfalfa. From 4 to 6 feet of water were required to reclaim this soil to a depth of 50 inches. Gypsum application in combination with leaching had little or no effect on reducing exchangeable sodium. Plots leached with 6 feet of water yielded 5.15 tons of alfalfa hay per acre, as compared with 4.37 tons of alfalfa hay per acre from plots leached with only 2 feet of water.

3605. Amer, A. V. EXPERIMENTAL STUDIES OF THE CONTROL OF LEVEL OF UNDERGROUND WATERS OF IRRIGATED LANDS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 87: 151-157. 1963. 20 M857

3606. Ananyan, G. T. BIOLOGICAL DRAINAGE FOR CONTROL OF SOIL SALINIZATION ON THE ARAS LOWLANDS. (Arm) Armenia Min. Sel'sk. Khoz. Upravlenie Sel'skokhoz. Nauki. Izv. Sel'skokhoz. Nauki. 1961(7/8): 113-116. 1961. 20 Ar52
Russian summary.

3607. Antipov-Karataev, I. A., and Kerzum, P. A. THE SYSTEM OF RECLAMATION METHODS FOR EXPLOITING SALINE AND SWAMPED SOILS AND AGAINST SECONDARY SALINIZATION OF IRRIGATED SOILS IN TADZHIKISTAN. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 281-284. 1961. 278.9 Un3

A report was given on some reclamation methods used in Russia on saline soils, waterlogged soils, and against the secondary salinization of irrigated soils.

3608. Antipov-Karataev, I. N. SOLONETZ IMPROVEMENT IN U.R.S.S. (Rus) Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comn. VI): 531-536. 1956. 56.09 In8452
English summary.

A report was given on the solonetz soils that cover 50 to 60 million hectares in virgin territories such as East Siberia, Kazakhstan, Altai, and the Volga region.

Due to the slow process of interaction of the solonetz horizon with gypsum and calcium carbonate (from 10 to 20 years) other agricultural methods were devised.

This can be achieved by spreading additional earth on top of the solonetz or by subsoiling the solonetz with special cultivators.

3609. Antipov-Karataev, I. N. PHYSICAL CHEMICAL INVESTIGATIONS IN CONNECTION WITH THE IMPROVEMENT OF ALKALI SOILS. (Ge) Internatl. Cong. Soil Sci. Trans. 7(1): 571-576. 1960.
56.09 In847T
English summary.

A report was given on the "self amelioration" of solonetz soils in the U.S.S.R. with and without the use of irrigation.

3610. Antipov-Karataev, I. N., Iurin, I. A., Frolkina, L. A., and Kader, G. M. RECLAMATION OF SOLONETZ (ALKALI SOILS) IN THE CHERNOZEM ZONE OF THE USSR. (Rus) Pochvovedenie. 1957(2): 1-17. Feb. 1957. 57.8 P34

3611. Antipov-Karataev, I. N., and Pak, K. P. SOLONETZ SOILS MUST BE CONVERTED INTO FERTILE LANDS. (Rus) Zemledelie. 7(11): 44-50. Nov. 1959. 20 Z44

3612. Antipow-Karatajew, I. N. PHYSICAL-CHEMICAL INVESTIGATIONS INTO THE RELATIONSHIP OF ALKALI SOILS. (Rus) Internatl. Cong. Soil Sci. Trans. 7(I): 571-576. 1960.
56.09 In847T

Gypsum is used on a large scale in the Soviet Union for improving solonetz soils. But there is so much land with solonetz-like soils that 500 to 1000 million tons of gypsum would be necessary for their complete amelioration. New chemicals, like calcium chloride are being tried. This requires the development of theoretical investigations into the problems of the evolution of different kinds of solonetz soils and a thorough characterization of their properties.

Special attention has been given to the possibilities of utilizing the "inner reserves" of solonetz soils and their "self-amelioration"—among them the presence of gypsum or calcium carbonate at available depths of the solonetz soils; and the presence of considerable quantities of colloids with favorable agronomic properties.

3613. Apacible, A. R. IRRIGATION AND DRAINAGE OF SUGARCANE BY TARLAC DEVELOPMENT CORPORATION. Philippine Sugar Inst. Q. 7(2): 53-74. Ref. June 1961. 65.9 P533

A report was given on the irrigation and drainage practices used for sugarcane by the Tarlac Development Corporation in the Philippines.

3614. Apacible, A. R. IRRIGATION AND DRAINAGE OF SUGARCANE BY TARLAC DEVELOPMENT CORPORATION. Sugar News [Manila] 37(7): 323-336. map. Ref. July 1961. 65.8 Su36

A report was given on the irrigation and drainage sugarcane project of the Tarlac Development Corporation in the Philippines.

3615. Aran', S. AMELIORATION OF ALKALI SOILS. (Rus) Pochvovedenie. 1957(7): 1-12. July 1957.
57.8 P34

3616. Araujo, F. C. De. ADAPTATION TO IRRIGATION; SOIL LEVELING. (Por) Agricultura [Lisboa] 17: 23-25. Jan./Mar. 1963. 15.5 Ag85

3617. Aristov, S. G. LEACHED SOILS SALINIZED WITH SODIUM SULPHATE. (Rus) Pochvovedenie. 1962(7): 26-30. Ref. July 1962. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 7: 669-702. Ref. July 1962. 57.8 P34Ae

A report was given on the leaching of soils salinized with sodium sulphate in the U.S.S.R. in the summer.

3618. Aronovici, V. S. IRRIGATION PRINCIPLES AND PRACTICES. In Tourje, E. C., ed. CAMELIA CULTURE, pp. 343-359. 1958. 97.31 T64

A report was given on irrigation principles and practices for growing camellias. The use was discussed of tensiometers and electric resistance units for soil moisture measurement. The drainage requirements were given for camellias—especially for those raised in pots.

3619. Asghar, A. G., and Khan, M. A. H. FIELD STUDIES IN PREVENTION OF SOIL SALINIZATION. Agron. J. 50(11): 667-671. Nov. 1958. 4 Am34P

Field studies were reported on the prevention of soil salinization in West Pakistan. Different rotations were suggested to use to keep the salt below the root zone of plants. Leaching of the salts was recommended for areas where the salt was already in the root zones.

3620. Astapov, S. V., and Spengler, V. U. PREVENTION AND CONTROL OF SALINIZATION AND SWAMP FORMATION ON IRRIGATION LANDS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury, 158 pp. Ref. 1956. 55 As8P

3621. Astapovich, B. V. HYDRAULIC CONSTRUCTION IN THE POLISH PEOPLE'S REPUBLIC. (Rus) Gidrotekh. i Melior. 1960(4): 59-63. Apr. 1960. 290.8 G362

3622. Aubert, P. N., Shearer, M. N., and Meyle, W. A. IRRIGATION AND DRAINAGE; A PANEL. Oreg. State Hort. Soc. Proc. 47: 28-31. 1955. 81 Or32

A report was given on a panel discussion by members of the Oregon State Horticultural Society on irrigation and drainage.

3623. Aver'yanov, S. F. HORTIZONTAL DRAINAGE IN THE CONTROL OF SALINIZATION OF IRRIGATED LANDS. (Rus) Moskva, Akademiya Nauk. 82 pp. 1959. 54 Av32

3624. Avtonomov, A. A. EFFECTIVENESS OF DOUBLE LEVEL SUBSOILING OF SALTY SOILS OF THE GOLODNAYA STEP. (Rus) Khlopkovodstvo. 12: 35-38. Dec. 1962. 72.8 K522

3625. Ayazi, M. DRAINAGE AND RECLAMATION PROBLEMS IN THE GARMSAR AREA. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 285-290. map. 1961. 278.9 Un3

A report was given on the study of drainage and reclamation problems in the Garmsar area of Iran.

3626. Ayers, A. D. THE IMPROVEMENT OF SALINE AND SODIC SOILS. Potassium Symp. Papers, Cong. 7: 259-270. Ref. 1962. 385 P842

A report and review of the literature were given on the improvement of saline and sodic soils.

3627. Ayers, A. D., Vazquez, A., de la Rubia, J., Blasco, F., and Samplon, S. SALINE AND SODIC SOILS OF SPAIN. Soil Sci. 90(2): 133-138. Ref. Aug. 1960. 56.8 So3

A report was given on the reclamation and irrigation of salt-affected soils in Spain.

3628. Azarnia, E. A. REHABILITATION OF SHABANKAREH PROJECT. Near East-S. Africa Irrig. Pract. Seminar. [Proc.] 5: 213-219. 1964. 173.2 In8Reg

A report was given of the irrigation and drainage practices needed for the rehabilitation of the Shabankareh Project in Iran.

3629. Azevedo, A. L. THE TECHNOLOGY OF PEATY SOILS IN MOZAMBIQUE AND ANGOLA. Internatl. Cong. Soil Sci. Trans. 5(3): 398-401. 1954. 56.09 In845A

The reclamation of the peat soil in Mozambique and Angola were discussed. The system is so regulated as to permit irrigation during the day season and drainage during the rainy season.

3630. Bagirov, S. N. LEACHING OPERATIONS AND UTILIZATION OF SALINIZED LANDS ACCOMPANIED BY DRAINAGE IN THE MUGANO-SAL'YANSK MASSIF. (Az) Akad. Nauk Azerb. SSR. Dok. 17(10): 941-945. maps. 1961. 511 Ak147D
Russian summary.

3631. Baitkanov, K. A. RECLAMATION OF SOLONETZ SOILS. (Rus) Zemledelie. 10: 24-30. Oct. 1964. 20 Z44

3632. Balyabo, N. K. ON THE DIFFERENTIATION OF SOLONETZ SOIL RECLAMATION METHODS. (Rus) Internatl. Cong. Soil Sci. Rpt. Soviet Soil Sci. 7: 405-411. 1960. 56.09 In847D
English summary.

3633. Balyabo, N. K. IRRIGATION OF MEADOW-BOGGY SOILS AT THE EXPENSE OF GROUND WATER. (Rus) Khlopkovodstvo. 1961(1): 52-56. Jan. 1961. 72.8 K522

3634. Bamesberger, J. G. PREPARING LAND FOR EFFICIENT IRRIGATION. U.S. Dept. Agr., Ybk. Agr. 1955: 279-285. 1955. 1 Ag84Y

A report was given on land leveling for efficient irrigation.

3635. Bamesberger, J. G. PREPARING LAND FOR EFFICIENT IRRIGATION. Australia Irrig. 2(2): 11, 13-16. Nov. 1957. 55.8 Au7

A discussion was given of land leveling for efficient irrigation. The effects of drainage and reclamation on alkali areas were given.

3636. Barker, R. F. WATER AND AGRICULTURE IN THE EL PASO VALLEY. Tex. Business Rev. 32(8): 6-8. Aug. 1958. 280.8 T312

A report was given of an improved irrigation and drainage system of the El Paso Valley in Texas. Statistics were given of the value of farm products produced in the area.

3637. Barkla, F. J., Garland, K. R., and Jones, G. O. RECLAMATION TRIALS—SWAN HILL IRRIGATORS' RESEARCH FARM. J. Agr. [Melbourne] 62(7): 291-296. July 1964. 23 V66J

A report was given on reclamation trials on saline soils in a pasture area of Australia. Trials on drainage, irrigation, fertilizers, soil amendments, mulching, and cultivation were reported.

3638. Baron, V. A. VERTICAL DRAINAGE OF SALTY SOILS. (Rus) Khlopkovodstvo. 10: 39-41. Oct. 1963. 72.8 K522

3639. Bekhbudov, A. K. RECLAMATION AND IMPROVEMENT OF SALINE SOILS IN AZERBAIJAN. (Rus) Gidrotekh. i Melior. 1962(5): 3-10. May 1962. 290.8 G362

3640. Benitez-Lopez, E. INTENDED SYSTEM FOR DRAINAGE CASING. (Sp) Ingen. Hidraul. en Mex. 17(1): 49-62. Jan./Mar. 1963. 290.8 In43
English summary, pp. III-IV of yellow supplement.

A report was given of a drainage project in Mexico where concrete tile is being used to drain irrigated cotton fields.

3641. Berg, F. A CONTRIBUTION TO WATER REGULATION BY WATER RETENTION AND SUBIRRIGATION. (Ge) In WEGE ZUR ERREICHUNG DES WELTHOCHSTSTANDES IM FUTTERBAU. Berlin, Deutscher Landwirtschaftsverlag, pp. 31-36. 1960. 60 W42

3642. Bernstein, L., Fireman, M., and Reeve, R. C. CONTROL OF SALINITY IN THE IMPERIAL VALLEY, CALIFORNIA. U.S. Dept. Agr., Agr. Res. Serv. ARS-41-4, 16 pp. Dec. 1955. A56.9 R31

A "popular type" publication was given on the causes and control of salinity. A soil test was recommended for farms in the area. The following good management practices were recommended: (1) Level properly; provide drainage; leach if necessary; select suitable crops and plant properly; and irrigate adequately.

3643. Besednov, N. A. RECLAMATION OF SOLONCHAKS BY THE MUGAN EXPERIMENT-RECLAMATION STATION. (Rus) Pochvovedenie. 1956(11): 1-5. Nov. 1956. 57.8 P34

3644. Besednov, N. A. LEACHING AND DRAINAGE OF HEAVY SOLONETZ-SOLONCHAK SOILS. (Rus) Poch. Inst. im. V. V. Dokuchaeva. Trudy. 52: 123-219. Ref. 1957. 56.9 P44

3645. Besednov, N. A. IMPROVEMENT OF SALTY SOILS. (Rus) Gos. izd-vo selkhoz lit-ry, 147 pp. 1958. 54 B462

3646. Bianchi, W. C., Haskell, E. E., and Johnston, W. R. A SOIL-DRAINAGE STUDY IN SOUTHWESTERN FRESNO COUNTY. Hilgardia. 33(5): 171-178. map. Nov. 1962. 100 C12H

The conditions associated with a developing drainage problem in Fresno County, Calif. were studied. Due to irrigation, a semiperched water table has risen into the crop zone. The soluble-salt content of this water has built up the salinity of the surface soils.

3647. Biggar, J. W., and Nielsen, D. R. IMPROVED LEACHING PRACTICES SAVE WATER, REDUCE DRAINAGE PROBLEMS. Calif. Agr. 16(3): 5. Mar. 1962. 100 C12Cag

A report was given on the use of rainwater or irrigation water for leaching by methods other than ponding.

3648. Bina, D. IMPROVEMENTS ARE AN EFFECTIVE INVESTMENT INTO SOILS. (Cz) Ekon. Zemedel. 1(2): 47, 50. Feb. 1962. 281.8 Ek7

3649. Blaney, H. F., and Huberty, M. R. IRRIGATION IN THE FAR WEST. Agr. Engin. 38(6): 414-417, 421. June 1957. 58.8 Ag83

A report was given on the principles and practices of irrigation in the western area of the United States.

3650. Bloemen, G. W. THE ADJUSTMENT OF DITCH GAGES TO THE REQUIRED GROUNDWATER DEPTH. (Du) Nederland Heidemaatsch. Tijdschr. 69(3): 51-59. Mar. 1958. 12 N282

3651. Bobchenko, V. I. SUBSOIL MOLE-TRACK IRRIGATION IN ROSTOV REGION. (Rus) Vsesoiuzn. Akad. Sel'skokhoz. Nauk im. V. I. Lenina. Dok. 21(4): 45-48. 1956. 20 Ak1

3652. Bobchenko, V. I. SUBSOIL IRRIGATION THROUGH CERAMIC PIPES. (Rus) Vsesoiuzn. Akad. Sel'skokhoz. Nauk im. V. I. Lenina. Dok. 21(12): 41-45. 1956. 20 Ak1

3653. Bobchenko, V. I. SUBSURFACE MOLE IRRIGATION ON CLAY LOAM CHERNOZEMS IN KURSK REGION. (Rus) Akad. Nauk SSSR. Inst. Fiziol. Rast. im. K. A. Timirianeva. Sborn. Rabot. 1956(2): 155-184. Ref. 1956. 55 Ak1

3654. Bobchenko, V. I. STABILITY OF MOLE DRAINS IN UNDERGROUND MOLE IRRIGATION. (Rus) Vest. Sel'skokhoz. Nauk. 3(6): 116-124. Ref. June 1958. 20 V633
English summary.

The use and construction of mole drains for underground mole irrigation were given for the U.S.S.R.

3655. Boddy, H. AGENCIES TEAM UP TO HELP RANCHERS GET GOOD GRASS. Soil Conserv. 25: 103-104. 1960. 1.6 So3S

Good grass growth and drainage helped C. O. Bankhead and son whip a tough alkali condition on their wet lands near Bethany in San Joaquin County, Calif.

The Bankheads' success in getting grass to grow on alkaline, salty acres called for giving their land the full conservation treatment, including drainage, land leveling, relocation of irrigation borders, and reseeding to improved grasses and legumes plus proper grazing use.

3656. Bol'shakov, A. F. PRACTICES IN RECLAMATION OF THE SOLONCHAK SOLONETZ SOILS AND WAYS OF UTILIZING THE SOILS OF THE SOLONETZ COMPLEX. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 38: 12-20. 1958. 99.9 Ak1

3657. Borovskii, V. M. THE PROBLEM OF SOIL RECLAMATION AND AMELIORATION IN DESERT REGIONS OF KAZAKHSTAN. (Rus) Pochvovedenie. 1957(4): 1-9. Apr. 1957. 57.8 P34
English summary.

The following three problems of soil reclamation and amelioration were discussed for the Desert Regions in Kazakhstan: (1) Chloride type of salinization; (2) chloride-sulfate type of salinization; and (3) the sulfate-soda type of salinization.

Methods of solving the problems were given.

3658. Botzan, M., Haret, C., Petrescu, N., and Merculiev, O. DRAINAGE AND IRRIGATION PROBLEMS OF BARAGAN PLAIN. (Rum) Bucharest Inst. de Cercet. Agron. Metode, Rap. Mem. (n.s.) 29, 200 pp. maps. Ref. 1959. 106.4 R86
English summary.

A report was given on drainage and irrigation problems in the Baragan plain in Rumania and some research results and needs to help solve the problems.

3659. Boumans, J. H., and Hulsbos, W. C. THE ALKALI ASPECTS OF THE RECLAMATION OF SALINE SOILS IN IRAQ. Netherlands J. Agr. Sci. 8(3): 225-235. Ref. Aug. 1960. 12 N3892

A report was given on the alkali aspects of the reclamation of saline soils in Iraq.

3660. Bovmans, J. G. DRAINAGE AND LAND RECLAMATION EXPERIMENTS IN DUJAILAH. (Ara) Iraq Min. Agr. Apr./Sept. 1956. 22.5 IR1
English summary, pp. 3-4.

Preliminary investigations were given on the reclamation of alkali lands in Iraq. Appropriate soil management practices were needed in addition to the drainage and irrigation of the area.

3661. Bower, C. A. CHEMICAL AMENDMENTS FOR IMPROVING SODIUM SOILS. U.S. Dept. Agr., Agr. Res. Serv. Inform. Inform. B. 195: 9 pp. 1959. 1 Ag84Ab

Chemical amendments for improving sodium soils were given. The suitability, application rates, and methods of application of various amendments were discussed.

3662. Bower, C. A., Haise, H. R., Legg, J., Reeve, R. C., Carlson, R., Dregne, H. E., and Whitney, R. S. SOIL SALINITY AND IRRIGATION IN THE SOVIET UNION: REPORT OF A TECHNICAL STUDY GROUP. U.S. Dept. Agr., Agr. Res. Serv. Rpt. Tech. Study Group (Unnumbered) 41 pp. 1962.

Under an exchange agreement, a technical study group, consisting of specialists in soil salinity, irrigation, drainage, agronomy, and agricultureal econonics, visited the Soviet Union during the period June 27 to July 29, 1960. The primary purpose of the visit was to study soil salinity in the U.S.S.R., but opportunity was also afforded to study irrigation agriculture in general because of its close relation to soil salinity. The information was obtained by direct measurements, observations, and from discussions with Soviet scientists.

3663. Boyaci, R., and Savaskan, C. CUMRA-KARKIN IRRIGATION DEVELOPMENT PROJECT. Near East-S. Africa Irrig. Pract. Seminar. [Proc.] 5: 316-330. map. 1964. 173.2 In8Reg

A report was given on the farm layout and distribution of the irrigation and drainage systems for the Cumra-Karkin irrigation project in Turkey.

3664. Branson, R. L., and Fireman, M. RECLAMATION OF AN IMPOSSIBLE ALKALI SOIL. Internatl. Cong. Soil Sci. Trans. 7(I): 543-552. 1960. 56.09 In847T

A 4-year field experiment was conducted to determine if it were possible to reclaim a so-called "unreclaimable" saline-alkali soil representing an extreme reclamation problem.

The most effective treatment was calcium chloride. Following calcium chloride in effectiveness were the acidifying amendments: Sulfuric acid; sulfur; and ferric sulfate.

Gypsum increased yields to the same extent as the acidifying amendments but only after a much longer period of leaching. Treatments which supplied little or no soluble calcium did not reclaim this soil.

3665. Brenes, E. J., and Perez-Escolar, R. DIAGNOSIS AND IMPROVEMENT OF SALINE AND ALKALINE SOILS WITH EMPHASIS ON THE CASE OF THE LAJAS VALLEY. (Sp) Rev. de Agr. de P. R. 50(2): 102-113. July/Dec. 1963, pub. 1964. 8 R325

3666. Brown, E. M. LEVELING, ASPHALT DITCH LINING PART OF IRRIGATION PREPARATION. Land Impr. 3(12): 10-11. Dec. 1956. 282.8 L224

A report was given on the value of land leveling and lining irrigation ditches with asphalt before irrigation is started on an area.

3667. Bryan, B. B. EDUCATION FOR CONTINUOUS IRRIGATION IN THE HUMID AREAS. J. Irrig. and Drain. Div., ASCE 85(IR 3): 1-14. Sept. 1959. 290.9 Am3Ps

Irrigation engineers inevitably serve as irrigation educators. As educators they should be familiar with the factors effecting costs, production, and consequent net profits. These include irrigation frequency, land surface preparation, drainage, and water distribution. An analysis of data concerning these and other factors were presented.

3668. Bud'ko, Y. N. SALINIZATION OF SOILS IN THE AZOV IRRIGATION SYSTEM AREA, ROSTOV REGION. (Rus) Pochvovedenie. 1958(4): 74-85. Ref. Apr. 1958. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 4: 409-418. Ref. Apr. 1958. 57.8 P34Ae

A method was given for improving saline soils caused by irrigation by the construction of a net of canals and drains.

3669. Buras, N., Spencer, J. R., and Pillsbury, A. F. COST OF RECLAMATION AND DEVELOPMENT OF SOME SALINE LANDS. Trans. ASAE 4(1): 95-98. 1961. 290.9 Am32T

A report was given on the cost of reclamation and development of some virgin saline lands in California. Costs were given for: Clearing; surveying; land leveling; tile drainage; preleaching operations; leaching; land preparation after leaching; and cost of irrigation system.

3670. Campbell, R. B. SALINITY IN RELATION OVERHEAD IRRIGATION. Hawaii Sugar Technol. Rpt. 20: 255-261. Ref. 1961, pub. 1962. 65.9 H317

A report was given on soil salinity in relation to overhead irrigation in Hawaii. A method was given for determining the field application for leaching saline soils with an overhead irrigation system.

3671. Carlos, A. D. P., and Sanches, R. A. D. S. PROBLEMS WITH THE RECLAMATION OF THE SALT WATER MARSHES OF ALGARVE. (Fr) Cong. Irrig. and Drain. Trans. 4(3): 11.755-11.770. maps. 1960. 55.9 C7652

A report was given on the reclamation of salt water marshes of Algarve, Spain by leaching by rainwater of the drained areas.

3672. Carmody, R. SHAPING LAND FOR WATER MANAGEMENT: WATER DRAINED FROM A PUDDLED FIELD OR WATER ADDED TO A DRY ONE CAN SAVE THE CROP; LAND SHAPING PREPARES FOR BOTH DRAINAGE AND IRRIGATION. Farm Q. 18(3): 64-65, 113-114, 116. Aug./Oct. 1963. 6 F22995

A report was given on the need and use of land shaping for the drainage of irrigated lands.

3673. Carter, D. L., and Fanning, C. D. COMBINING SURFACE MULCHES AND PERIODIC WATER APPLICATIONS FOR RECLAIMING SALINE SOILS. Soil Sci. Soc. Amer. Proc. 28(4): 564-567. July/Aug. 1964. 56.9 So3

A report was given on the advantages of using cotton by mulch or chopped shrubbery mulches and periodic water applications for reclaiming saline soils in Texas. The higher efficiency for mulched soil was attributed to the reduced evaporation under mulches that reduced the upward movement of water.

3674. Chahal, R. S. REMOVAL OF SALTS FROM SALINE-ALKALI SOILS BY USE OF POROUS DUCTS. Indian Soc. Soil Sci. J. 10(4): 289-293. Dec. 1962. 56.9 In2

A report was given on a laboratory experiments studying the need of porous channels or ducts filled with sand or organic matter to help remove salts from saline-alkali soils in India.

3675. Chang, C. W., and Dregne, H. E. RECLAMATION OF SALT—AND SODIUM—AFFECTED SOILS IN THE MESILLA VALLEY. N. Mex. Agr. Expt. Sta. B. 401, 27 pp. Ref. Nov. 1955. 100 N465

Greenhouse and field results were reported on the reclamation of salt—and sodium—affected soils in New Mexico by leaching and/or use of soil amendments and its effects on plant growth.

3676. Chapman, H. D. ALKALI SOIL RECOVERY. III. 4 CASE HISTORIES OF RECLAMATION. World Farming. 1(4): 26-29. Apr. 1959. 30.08 W89

Four case histories were given of alkali soil improvement in California.

3677. Chapman, H. D. THE CULTIVATION OF CITRUS. II. IRRIGATION AND DRAINAGE. World Crops. 11(6): 217-219. June 1959. 281.8 W892

A report was given on the irrigation and drainage requirement of citrus in California.

3678. Chaudhri, I. I., Shah, B. H., Navqvi, N., and Mallick, I. A. INVESTIGATIONS ON THE ROLE OF SUAEDA FRUTICOSA FORSK IN THE RECLAMATION OF SALINE AND ALKALINE SOILS IN WEST PAKISTAN PLAINS. Plant and Soil. 21(1): 1-7. Aug. 1964. 450 P696

A report was given on the use of Suaeda fruticosa Forsk to reclaim saline and alkaline soils in West Pakistan by collecting non-saline blown soil and by absorbing large quantities of salt from the topsoil.

3679. Chernen'kii, M. A. ON IMPROVING THE SOLONETZ SOILS OF THE SOUTH OF UKRAINIAN SSR. (Rus) Pochvovedenie. 5: 74-75. May 1955. 57.8 P34

3680. Chizhevskii, M. G., Polovitskii, I. I., and Ishigenov, I. A. ON THE RECLAMATION OF SOLONETZ SOILS IN NORTHERN-KAZAKHSTAN REGION. (Rus) Zemledelie. 4(6): 13-20. June 1956. 20 Z44

3681. Christensen, P. D. WHAT TO DO ABOUT SALINE AND ALKALI SOILS. Utah State Agr. Coll. Ext. L. 5, 6 pp. folder. Jan. 1956. 275.29 Ut1L

An illustrated guide was given on the control, management, and reclamation of saline and alkali soils in Utah.

3682. Christiansen, J. E. IRRIGATION AND DRAINAGE PROBLEMS IN URUGUAY. J. Irrig. and Drain. Div., ASCE 86(IR 2): 1-8. June 1960. 290.9 Am3Ps

A report was given on the irrigation possibilities in Uruguay. Some areas require flood control and drainage before intensive agriculture can be practiced.

3683. Churikov, I. I. IRRIGATION OF RICE ON SALINE SOILS OF CISCASPIAN DEPRESSION. (Rus) Gidrotekh. i Melior. 4: 34-38. Apr. 1964. 290.8 G362

3684. Cobos, L. P. De Los. SANDING IN SALINE SOILS DALIAS PROJECT, ALMERIA, SPAIN. Cong. Irrig. and Drain. Trans. 4(5): 13.57-13.63. 1960. 55.9 C7652

A report was given on the beneficial effect of adding sand to saline soils in Spain.

3685. Colvin, J., Jr. BASIN IRRIGATION SYSTEM STOPS HIGH PUMPING COSTS. Soil Conserv. 29(11): 258-259. 1964. 1.6 So3S

A report was given on the advantages of surface drainage for basin irrigation systems. In Arizona, a basin irrigation systems of 140 acres was irrigated with the same amount of irrigation water needed for 100 acres under the previous systems used.

3686. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON EFFECT OF GYPSUM ON PROPERTIES OF SALINE AND ALKALI SOILS (1958-1946). Commonwealth Bur. Soil Sci. [Annot. Bibliog.], 8 pp. June 1960. 241 C734A

An annotated bibliography was given of articles published during 1946-58 on the effect of gypsum on saline and alkali soils.

3687. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON RECLAMATION ON ALKALI SOILS (1960-1954). Commonwealth Bur. Soil Sci. [Annot. Bibliog.], 5 pp. Jan. 1961. 241 C734A

An annotated bibliography was given of articles published during 1954-60 on the reclamation of alkali soils.

3688. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON SALINITY IN RELATION TO DRAINAGE (1964-1956). Commonwealth Bur. Soils [Annot. Bibliog.] 796, 11 pp. 1964. 241 C734A

An annotated bibliography was given on salinity in relation to drainage for the period 1956-1964.

3689. Corbett, C. C. THE DISPOSAL OF DRAINAGE OF IRRIGATED FARMS IN FLAT COUNTRY. Internatl. Comn. Irrig. and Drain. Annu. B. 1959: 30-33. map. 1959. 55.9 In8A

A discussion was given on the disposal of drainage water from irrigated farms in flat country in Australia.

3690. Criddle, W. D., and Haise, H. R. IRRIGATION IN ARID REGIONS. U.S. Dept. Agr., Agr. Ybk. 1957: 359-367. 1957. 1 Ag84Y

A discussion was given on the need and use of irrigation in arid regions in the United States. The need and use of drainage along with the irrigation were stressed.

3691. Cruz, S. R., and Laudencia, P. N. IRRIGATION OF RICE BY PUMPING. Soil Sci. Soc. Philippines. J. 8(4): 208-222. Fourth Q. 1956. 56.9 So35

A report on the irrigation of rice by pumping was given for the Philippines that included the costs involved.

3692. Darab, K. RE-ACCUMULATION OF SALTS IN IRRIGATED SOILS OF THE HUNGARIAN LOWLAND. (Rus) Pochvovedenie. 11: 41-47. Ref. Nov. 1955. 57.8 P34

3693. Darab, K. SECONDARY FORMATION OF ALKALI SOILS IN THE IRRIGATED REGION OF THE HUNGARIAN PLAIN. Cong. Internatl. de la Sci. du Sol. 6(D comn. VI): 597-602. 1956. 56.09 In8452

A report was given on the effect of alkali on the Hungarian Plain under irrigation or areas planned for future irrigation.

3694. Darab, K. SECONDARY ALKALIZATION OF IRRIGATED MEADOW SOILS OF THE REGION EAST THE TISZA RIVER. (Hu) Agrokem. es Talajtan. 7(1): 53-64. Ref. Mar. 1958. 385 Ag83
English summary.

A report was given on secondary alkalization of irrigated soils in Hungary where drainage was needed.

3695. Darab, K., and Szabolcs, I. TYPES OF SECONDARY SALINIZATION OF SOILS IN THE IRRIGATED ZONES OF THE REGION OF THE GREAT HUNGARIAN PLAIN. Internatl. Cong. Soil Sci. Trans. 7(1): 535-542. 1960. 56.09 In847T

A report was given on the three types of secondary salinization of soils in the irrigated zones of the Hungarian Plain. Recommendations for reclaiming each of the areas were discussed.

3696. Darlot, A. DRAINAGE AND IRRIGATION. (Fr) France Min. de l'Agr. B. Tech. d'Inform. 185: 743-752. Ref. Nov./Dec. 1963. 14 F844B

3697. Davis, S., and Pugh, W. J. INEXPENSIVE LAND PREPARATION FOR LEACHING. J. Soil and Water Conserv. 18(6): 246-247. Nov./Dec. 1963. 56.8 J822

A report was given of inexpensive land preparation used for leaching saline and alkali areas.

3698. Davis, S., Schumaker, G. A., and Pepper, J. H. CAREFUL IRRIGATION + ADEQUATE FERTILIZER = FEWER MOSQUITOES + INCREASED PRODUCTION. Mont. Agr. Expt. Sta. C. 239, 6 pp. 1962. 100 M76

Permanent ponds and oxbows have long been blamed for mosquito production. In a Milk River Valley study in Montana, the real culprit turned out to be irrigation water standing on fields. Here, over 90 percent of the mosquitoes developed in irrigation water. Irrigation practices which controlled mosquitoes also led to increased corn yields. Results were better still when appropriate fertilizers were added.

If 5 days were assumed to be the minimum hatching time for mosquitoes, irrigation water should not be allowed to stand in the field for longer than this. The basic solution is soil and water management rather than chemical control.

Many mosquito-producing wheatgrass meadows are not level enough to allow even distribution of water. They should be broken out and leveled and a good irrigation system established. The area can then be reseeded.

3699. De Leeuw, A. DECADE OF WATER DEVELOPMENT IN ISRAEL. Technion Ybk. 15: 69-74, 151-152. Ref. 1958. 475 T222

A report was given on the history of water development (irrigation and drainage) in Israel, and plans for future development.

3700. Dewan, M. L., and Bordar, M. A SUMMARY OF THE REPORT ON LEACHING EXPERIMENTS IN THE KARKHEH AREA, KHUZISTAN, IRAN. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 273-279. 1961. 278.9 Un3

A summary was given of leaching experiments of saline irrigated soils in Iran.

3701. Dhawan, C. L. RECLAMATION OF SALINE AND ALKALI SOILS. Internatl. Comn. Irrig. and Drain. Annu. B. 1955: 72-80. Ref. 1955. 55.9 In8A

Recommendations were given for the reclamation of saline and alkali soils in India.

3702. Dhawan, C. L., Kahlon, S. S., and Parkash, V. RECLAMATION OF SALINE AND ALKALI SOILS (FIELD EXPERIMENTS). Madras Agr. J. 48(11): 422-428. Nov. 1961. 22 M262

Field experiments were reported on the reclamation of saline and alkali soils in India by leaching or leaching plus organic material such as green manure crops, barnyard manure, and pressed mud.

3703. Dieleman, P. J., ed. RECLAMATION OF SALT AFFECTED SOILS IN IRAQ; SOIL HYDROLOGICAL AND AGRICULTURAL STUDIES. Internatl. Inst. Land Reclam. and Impr. P. 11, 175 pp. map. Ref. 1963. 54.9 In8

A comboned report was given on the reclamation of salt affected soils in Iraq.

3704. Dixey, F., and Shaw, S. H. INTRODUCTION: HYDROLOGY WITH REFERENCE TO SALINITY. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 15-23. Ref. 1961. 278.9 Un3

A review of the literature was given on some arid zone hydrology problems due to salinity as an introduction to the symposium on salinity problems in arid zones.

3705. Dmochowski, A. A PROPER SOIL MOISTURE MANAGEMENT ASSURES BETTER RESULTS IN FOREST NURSERIES. (Pol) Las Polski. 38(6): 5-6. Mar. 16/31. 1964. 99.8 L33

3706. Dobbs, P. J. WATER CONTROL IN BRITISH GUIANA. World Crops. 12(12): 457-460. Dec. 1960. 281.8 W892

A report was given on water control in British Guiana originally introduced by the Dutch, in order to convert saline coastal swamps into good agricultural lands.

3707. Dobrowolski, L. J. THE MOST IMPORTANT PROBLEMS OF AGRICULTURE AND WATER MANAGEMENT IMPROVEMENTS IN NORTHERN ITALY. (Pol) Wiad. Melior. i Lakarskie. 6(5): 110-112. map. Sept./Oct. 1963. 54.8 W63

3708. Dolgov, S. I., Egorov, L. I., and Pol'skii, M. N. STUDY OF CHANGES IN THE SALINITY OF GROUND WATER LAYERS DURING LEACHING. (Rus) Pochvovedenie. 1: 115-121. Jan. 1956. 57.8 P34

3709. Doneen, L. D. REPORT TO THE GOVERNMENT OF IRAQ ON DRAINAGE AND RECLAMATION OF SALINE SOILS AND RELATED IRRIGATION PRACTICES. Food and Agr. Organ. United Nations Expanded Tech. Asst. Program FAO Rpt. 1666, 10 pp. 1963. 281.9 F733E

A report was given on the reclamations in Iraq of saline soils and irrigated land by drainage.

3710. Donnan, W. W., and Bradshaw, G. B. THE DISPOSAL OF SEEPAGE AND WASTE WATER. Australas. Irrig. Pasture Impr. 4(2): 9-12, 36-37. Jan. 1959. 55.8 Au7

Nine different drainage problems of irrigated lands in Australia were discussed. Methods of disposing of seepage and waste waters were given.

The main aspects to be considered in investigations of drainage of irrigated lands are: Topography; soils; soil salinity; soils alkalinity; soil acidity; and the tables, sources, and quality of the ground water.

3711. Dregne, H. E. SOIL PROBLEMS IN IRRIGATED AGRICULTURE. In Beetle, A. A., ed. AGRICULTURAL PROBLEMS IN ARID AND SEMIARID ENVIRONMENTS. Wyo. Agr. Expt. Sta. B. 367: 3-10. 1960. 100 W99

A report was given on soil problems in irrigated agriculture.

3712. Drouhin, G. AGRICULTURAL ASPECTS OF WATER PROBLEMS IN ALGERIA. (Fr) France Min. de l'Agr. B. Tech. d'Inform. 142: 395-404. map. July/Aug. 1959. 14 F844B

3713. Dunn, L. E. NATURE AND MANAGEMENT OF SALT-AFFECTED SOILS. Nev. Ranch Home Rev. 2 (5, o.e. 6): 6-7. Spring/Summer 1963. 60.18 Sci2

A report was given on the nature and management of salt affected soils in Nevada. The use was discussed of drainage and leaching for saline soils and gypsum or sulfur plus drainage and leaching for the alkali soils. Management and irrigation practices to reduce salt affected soils were also reported.

3714. Dzeventskii, G., and Zarva, V. PREVENTION OF SOIL SALINITY. (Rus) Narod. Khoz. Uzbek. 7: 63-66. July 1963. 280.8 N164

3715. Dzhafarov, K. F. EXPERIMENT WITH THE LEACHING OF SALINE SOILS OF HEAVY TEXTURE. (Rus) Gidrotekh. i Melior. 11: 29-33. Nov. 1964. 290.8 G362

3716. Dzhulai, A. P. RICE ON SALTY SOILS. (Rus) Zemledelie. 10: 24-28. Oct. 1963. 20 Z44

3717. Egorov, V. V. SALINIZATION AND THE SOIL RECLAMATION CONDITIONS OF THE MARITIME DELTAS IN THE ARAL-CASPIAN AREA. (Rus) Pochvovedenie. 8: 21-30. Ref. Aug. 1956. 57.8 P34

3718. El-Khatib, A. B. THE GHAB DEVELOPMENT PROJECT. Cong. Irrig. and Drain. Trans. 4(3): 11.673-11.692. map. 1960. 55.9 C7652

A report was given on the reclamation of marshes in the Ghab development Project in Syria by drainage and irrigation.

3719. Elshabassy, A. I., Zikri, B., Mitkees, A. I., and Hussein, M. A. IRRIGATION AND DRAINAGE PRACTICES IN RELATION TO SALINITY CONTROL IN SOILS OF EDKO DISTRICT U.A.R. Near East-S. Africa Irrig. Pract. Seminar [Proc.], 5: 223-228. 1964. 173.2 In8Reg

A report was given on the irrigation and drainage practices used for salinity control in soils of the Edko district in the U.A.R.

3720. Enserink, G. A. R. SUBSOIL IRRIGATION (INFILTRATION) AS APPLIED IN SANDY AREAS IN THE NORTH EASTERN POLDER (NETHERLANDS). Cong. Irrig. and Drain. Trans. 3(4): 9.151-9.158. 1957. 55.9 C7652

An illustrated report was given on a complex system of tile drains, with adjustable inlet and outlet, in order to provide an adjustable water table in the field, as desired according to the soil type, the climate, and the kind and growing-stage of the crop, as it is used in the irrigation areas in the North Eastern Polder of the Zuyderseaworks in the Netherlands.

3721. Etdujaili, A. M. DRAINAGE AND SALINITY IN IRAQ WITH SPECIAL REFERENCE TO DUJAHILAH EXPERIMENTAL STUDY. Near East-S. Africa Irrig. Pract. Seminar. [Proc.], 5: 239-253. Ref. 1964. 173.2 In8Reg

The general phenomena of drainage and salinity of irrigated lands in Iraq were described. The results of part of the Dujailah drainage and land reclamation experiments on drainage for salinity control were given.

3722. Evans, N. A. RECLAMATION OF SALINE SOILS—A JOINT RESEARCH VENTURE BETWEEN ENGINEERING AND AGRICULTURE. (Abs.) Assoc. Land-Grant Coll. and U. Proc. 68: 205-206. 1954. 4 As7

A report was given on a cooperative study in the Grand Valley of western Colorado to solve the problem of a rising water table and associated salinity problems in an irrigated area. The water table was lowered by proper drainage. Leaching studies were made to reclaim the soil fertility. Following these practices, an experiment was set up to demonstrate the best soil and management practices for the area.

3723. Evans, N. A. RECLAMATION AND DRAINAGE OF SALINE-SODIC SOILS IN THE UPPER COLORADO RIVER BASIN. Cong. Irrig. and Drain. Trans. 4(5): 13.113-13.130. maps. 1960. 55.9 C7652

A report was given on reclamation by leaching and drainage by pumping on saline-sodic irrigated soils in Colorado. Leaching with 6 foot of water was found to be adequate for reclamation of a 4 foot soil zone. The addition of 50 percent extra irrigation water in the fourth year was found desirable to maintain a safe salt level.

3724. Ezafovich, A. S., and Duyunov, I. K. UTILIZATION OF GROUND WATERS FOR IRRIGATION BY REGULATING DRAINAGE. (Rus) Gidrotekhnika i Melioratsiya. 1961(4): 14-21. Apr. 1961. 290.8 G362

3725. Fanning, C. D., and Carter, D. L. THE EFFECTIVENESS OF COTTON BUR MULCH AND RIDGE-FURROW SYSTEM IN RECLAIMING SALINE SOILS BY RAINFALL. Soil Sci. Soc. Amer. Proc. 27(6): 703-706. Nov./Dec. 1963. 56.9 So3

A report was given on the effectiveness of cotton bur mulch and a ridge-furrow system in reclaiming saline soils by rainfall in Texas. The cotton bur mulch was the most effective.

3726. Fedorov, B. V. INCREASING THE EFFECTIVENESS OF LEACHING OPERATIONS ON SALINE SOILS. (Rus) Khlopkovodstvo. 1961(10): 39-44. Oct. 1961. 72.8 K522

3727. Fedorov, B. V. LEACHING OF SALTY SOILS. (Rus) Khlopkovodstvo. 6: 38-41. June 1964. 72.8 K522

3728. Finfrock, D. C., Raney, F. C., Miller, M. D., and Booher, L. J. WATER MANAGEMENT IN RICE PRODUCTION. Calif. U. Agr. Ext. L. 131, 16 pp. folder. Dec. 1960. 275.29 C12Lea

An illustrated report was given of water management practices and equipment for water management for rice production in California.

3729. Finkel, C. DRAINAGE OF IRRIGATED AREAS. (He) Symposium on Drainage Problems in Israel, 1956.

3730. Fireman, M. SALINITY AND ALKALI PROBLEMS IN RELATION TO HIGH WATER TABLES IN SOILS. In Luthin, J. N., ed. DRAINAGE OF AGRICULTURAL LANDS. Agronomy. 7: 505-513. 1957. 4 Am392

A report was given of salinity and alkali problems in relation to high water table in soils. The following factors were discussed: (1) Origin of saline and alkali soils; (2) the role of irrigation water quality; (3) effects of salinity and alkali upon plant growth; (4) saline soils; (5) the reclamation and management of saline soils; (6) amount of water required for leaching; (7) alkali soils; (8) the reclamation of alkali soils; (9) saline-alkaline soils; and (10) conclusion.

3731. Flannery, R. D. FIELD RECLAMATION TESTING PROCEDURES AND RESULTS IN THE MIDDLE EAST. Internatl. Cong. Soil Sci. Trans. 7(I): 553-559. 1960. 56.09 In847T

The field reclamation tests simulating field reclamation practice provided opportunities to determine closely how much leaching is required to remove harmful chemicals from the soil.

The tests demonstrated that soil amendments were not needed for reclamation where certain amounts of soluble calcium and magnesium salts existed.

The excessive accumulations of salts in the upper meter of soils in the areas represented by the three test sites were reduced to a safe level for normal plant growth with about one meter of leaching water.

3732. Foggo, A. S. IRRIGATION AND DRAINAGE OF ROSE BEDS. Canad. Rose Soc. Ybk. 1955: 51-53. 1955. 82 R72

A report on irrigation and drainage of rose beds was made for Canada. Tile drainage 2 feet deep was recommended.

3733. Fowler, J. L. PONDING PAYS OFF: RECLAIMING SALINE SOILS. West. Livestock. 44(8): 36, 38, 40. Apr. 1959. 49 W523

Reclamation of saline soils by ponding was very successful at Fallon, Nevada.

The following methods of dike preparation were given: (1) Construction of a dike 1-1/2 feet higher than the high point of the area around the field, for areas of permeable soils. And (2) on soils with a slowly permeable profile, a dike was built on one side of the field as under No. 1 and on the other three sides, a drain was dug with the drain spoil bank doing double duty as a dike. When the field was ponded, excess salt was carried away in the drainage water.

For "alkali" areas, gypsum in addition to ponding was needed to reclaim the land.

3734. Fox, R. L., Phelan, J. T., and Criddle, W. D. DESIGN OF SUBIRRIGATION SYSTEMS. Agr. Engin. 37: 103-107. Feb. 1956. 58.8 Ag83

Design features, requirements, advantages, and shortcomings of subirrigation were presented. Water is introduced into the soil by parallel feeder ditches run on the contour as well as through tile drains and mole drains.

3735. France Direction Generale du Genie Rural de Hydraulique Agricole. MANAGEMENT OF THE LAKE ALAOTRA AREA. (Fr) Riz et Rizicult. and Cult. 5: 12-14. map. First Q. 1959. 59.8 R52

3736. Franklin, W. T., Whitney, R. S., Code, W. E., and Reeve, R. C. RECLAMATION AND MANAGEMENT OF SALINE SODIUM SOILS, MOSCA-HOOPER AREA, SAN LOUIS VALLEY. Colorado Agr. Expt. Sta. Gen. Series P. 667, 28 pp. 1957. 56.7 C71

A report was given on the reclamation and management of some saline-sodic soils in Colorado.

3737. Fucer, W. H. RECLAMATION OF SALINE AND ALKALI SOILS. Plant Food Rev. 8(3): 7-9. Fall 1962. 57.8 P694

A report was given on the reclamation of saline and alkaline soils.

3738. Fujikawa, T., and Nagaishi, Y. ON THE IRRIGATION WATER FOR PADDY-FIELD IN TIDAL-LAND RECLAMATION DISTRICTS. 1-11. (Ja) Kyushu Agr. Res. 16: 57-58. Oct. 1955. 107.6 K996

3739. Garland, K. R., and Jones, G. O. RECLAMATION OF SALINE SOILS AT KERANG, VICTORIA, BY PONDING AND PUMPING FROM AN AQUIFER. Austral. J. Expt. Agr. and Anim. 3(10): 177-179. Ref. Aug. 1963. 23 Au792

A report was given for the reclamation of saline soils in Australia by ponding and pumping from an aquifer.

3740. Gartvig, V. URGENT PROBLEMS OF [IRRIGATED] LAND RECLAMATION IN KHOREZMA. (Rus) Khlopkovodstvo. 5(5): 56-58. May 1956. 72.8 K522

3741. Gattis, J. L. IRRIGATION AND DRAINAGE IN ARKANSAS. Cotton Gin and Oil Mill Press. 63(21): 30-32. Oct. 13, 1962. 304.8 C822

A discussion was given on the value of supplemental irrigation and good draiange for cotton in Arkansas.

3742. Gattis, J. L., Koch, K. A., and McVey, J. L. LAND GRADING FOR SURFACE IRRIGATION. Ark. Agr. Coll. Ext. C. 491, 29 pp. Feb. 1959. 275.29 Ar4

An illustrated guide was given on land grading for surface irrigation and drainage in Arkansas.

3743. Gattis, J. L., Koch, K. A., and McVey, J. L. LAND GRADING FOR SURFACE IRRIGATION. Ala. Agr. Ext. Serv. C.557, 29 pp. 1959. 275.29 AL1C

An illustrated guide was given on land grading for surface irrigation.

3744. Gerabek, K. AUSTRIAN PROBLEMS CONCERNING IRRIGATION AND DRAINAGE. Internatl. Comn. Irrig. and Drain. Annu. B. 1957: 42, 48. 1957. 55.9 In8A

A report was given on the need and use of open ditches and tile drainage on farmlands in Austria.

3745. Gibaly, H. E. GYPSUM FINENESS IN RELATION TO RECLAMATION OF ALKALI SOIL. Internatl. Cong. Soil Sci. Trans. 7(I): 528-534. 1960. 56.09 In847T

The effect of particle sizes on rapidity of reclamation of alkali soil was investigated. Finer gypsum particles were more efficient in reclaiming alkali soil than coarse particles. Gypsum has to be ground finely enough that 100 percent of the material should pass 100 mesh U.S. standard sieve. A logarithmic relationship between concentration of replaced sodium in the leachate and the volume of leachate was found. The logarithmic equation is helpful in predicting the degree of improvement of reclamation of alkali soil with a certain type of gypsum. No significant differences existed between particles of gypsum finer than 100 mesh size in correcting alkali characteristics of soil.

A chemical method for calibrating the efficiency of gypsum samples of different fineness and quality was proposed. The amount of calcium chelated from 0.2 gm. gypsum by 100 ml. 0.025 N disodium ethylene-diaminetetra-acetate at 45° C. after 10 minutes time reaction is a measure of the efficiency of any gypsum sample in correcting alkalinity in soil.

3746. Gomez-Pompa, P. CONSTRUCTION AND FUNTIONING OF THE DRAINS IN THE IRRIGATED ZONE OF ORELANA, BADAJOZ-CACERES, SPAIN. Cong. Irrig. and Drain. Trans. 4(6): C.327-C.352. 1960. 55.9 C7652

A report was given on the construction, function, and cost of drains in an irrigated region in Spain.

3747. Goryunov, N. S., and Badenko, I. I. EFFECT OF AERATIONAL DRAINAGE ON THE RESTORATION OF SALINIZATION OF THE SOIL. (Rus) Vest. Sel'skokhoz. Nauki [Alma-Ata]. 1961(10): 67-74. Oct. 1961. 20 Ak16

3748. Grabovskaia, O. RECLAMATION OF SALINE LANDS IN TADZHIKISTAN. (Rus) Khlopkovodstvo. 6: 56-60. Jan. 1956. 72.8 K522

3749. Grande, C. R. RECLAMATION OF SALINE MARSHLAND SUBMERGED IN WATER. (Fr) Cong. Irrig. and Drain. Trans. 4(2): 11.241-11.250. map. 1960. 55.9 C7652 English summary.

The successful reclamation of a saline marshland area by drainage was reported for an area in Spain. Dikes, surface drainage, and subsurface drainage systems all were used.

3750. Gratzl, D. ESTABLISHMENT OF GRASS-CLOVER MEADOWS AND SOWN PASTURES ON LIMELESS ALKALI SOILS WITH AND WITHOUT IRRIGATION. (Hu) In Szeged. Delafoldi Mezogazdasagi Kiserleti Intezet. KUTATASI EREDMENYEK A GYAKORLATNAK. pp. 84-87. 1960. 105.9 SzeK

3751. Gratzl, D. ESTABLISHMENT OF MEADOWS ON LIMELESS ALKALI SOILS WITH SOIL IMPROVEMENT AND IRRIGATION. (Hu) In Szeged. Delafoldi Mezogazdasagi Kiserleti Intezet. KUTATASI EREDMENYEK A GYAKORLATNAK. pp. 89-90. 1960. 105.9 Sz2K

3752. Graveland, D. M., and Toogood, J. A. GYPSUM AS AN AMELIORATING AGENT FOR SOLONETZIC SOILS IN ALBERTA. Canad. J. Soil Sci. 43: 1-6. 1963. 56.8 C162

The application of gypsum to a number of Alberta solonetzic soils in laboratory studies resulted in significant physical and chemical improvements in all soils except those with very high exchangeable sodium percentages. Data obtained in threshold concentration studies indicated that gypsum was effective as an amendment for the amelioration of solonetzic soils only if the exchangeable sodium did not exceed 20 to 25 percent of the total exchange capacity, assuming that the effective solubility of gypsum in the field is about one-half that of its saturated concentration.

3753. Gross, C. PERCHED WATER; WESTERN FARMERS DRAIN SHELF OF SALT WATER RISING UNDER THEIR LAND. Farm Mangt. 6(10): 28. Oct. 1957. 281.8 F2225

A report was given on a drainage plan in California to drain salt water rising in the area due to an impervious layer in the soil material.

3754. Gustiuc, L., Gheorghiu, E., and Poenescu, M. SALINE SOILS LOCATED IN THE GULENCA-BRAILA VILLGGE AREA AND SOIL IMPROVEMENT MEASURES NEEDED TO PUT IT TO USE. (Rum) Jassy. Inst. Agron. "Ion Ionescu de la Brad." Lucrari Sti. 1961: 121-138. 1961. 106.4 J31L French summary.

3755. Hagood, M. A. Dow, A. I., Snyder, D. E., and Watson, W. O. MANAGING SALINE SOILS IN THE COLUMBIA BASIN. Wash. State U. Agr. Ext., Ext. Mineo. 2435, 4 pp. June 1964. 275.29 W27Mi

A report was given on the management and reclamation of saline soils in the Columbia Basin of Washington.

3756. Hallgren, G. DRAINAGE AND IRRIGATION. (Sw) Jord—Groda—Djur. 19: 136-155. 1963. 11 J763

3757. Halsey, D. D. SALINITY CONTROL IN VINEYARDS. Western Fruit Grower. 15(5): 24. May 1961. 95.8 G762

A report was given on the use of irrigation, drainage, and cultivation to help control salinity in vineyards in California.

3758. Halsey, D. D., Spencer, J. R., Branson, R. L., and Marsh, A. W. VINEYARD SALINITY PROBLEMS: CORRECTED WITH SPECIAL LEACHING IN COACHELLA VALLEY TRIALS. Calif. Agr. 17(5): 2-3. 1963. 100 C12Cag

Annual leaching with heavy water applications by ponding, with the aid of plastic levees, or use of sprinklers, may be the answer to problems of excess salt accumulation in Coachella Valley vineyards. Trials in a Thompson Seedless vineyard showed marked improvement in vine condition following these special leaching practices. Previous installations of additional tile drains had not corrected this vineyard salinity problem.

3759. Harrison, D. S. WATER CONTROL IN LOW-LAND CITRUS. Citrus Indus. 42(3): 28-29. Mar. 1961. 80 C49

A report was given of the use of tile drainage for citrus production in Florida. Water control by both irrigation and drainage was stressed.

3760. Harrison, D. S., Speir, W. H., and Thomas, F. H. INSTALLATION AND OPERATION OF A SET OF WATER-TABLE PLOTS ON AN ORGANIC SOIL. Trans. ASAE 6(1): 3-5. 1963. 290.9 Am32T

Field studies using a 3 x 3 Latin square experimental design for statistical analysis and utilizing float-activated irrigation and drainage pumps for water control, through a system of periphery and by-pass ditches with interior overfall controls for ditch stage regulation, were put into operation at the Everglades Experiment Station. The objectives were to: Determine the effect of depth to water table on drainage and irrigation requirements; physical, chemical and biological soil characteristics; optimum depths to water table for vegetables and field crops; rate of subsidence or loss in surface elevation; weed ecology and control; incidence of disease and control; and incidence of subterranean insects and their control; and microclimatology.

3761. Harrison, R. W. LAND FORMING IS RESHAPING DELTA FARMS—AND IT PAYS OFF BIG. Land Impr. 6(5): 18-20. May 1959. 282.8 L224

The economics and use of land forming for the Delta area in the United States were discussed The land forming was used for both irrigation and surface drainage.

3762. Hart, M. G. R., Carpenter, A. J., and Jeffery, J. W. O. PROBLEMS IN RECLAIMING SALINE MANGROVE SOILS IN SIERRA LEONE. Agron. Trop. [Paris] 18(8): 800-802. Aug. 1963. 26 Ag86

A report was given on some problems of reclaiming saline Mangrove soils in West Africa.

3763. Hausenbuiller, R. L. MATERIALS FOR ALKALI SOIL-RECLAMATION. Wash. Agr. Expt. Sta., Sta. C. 304, 7 pp. Apr. 1957. 100 W27S

A report was given on the need and use of gypsum, sulfuric acid, iron sulfate, sulfur, calcium polysulfide, and Blu Chip Sulfur for the reclamation of alkali soil in Washington.

3764. Hausenbuiller, R. L., Moodie, C. D., and Smith, H. W. SALINE AND ALKALI SOILS UNDER IRRIGATION IN WASHINGTON. Wash. Agr. Expt. Sta., Sta. C. 302, 8 pp. Apr. 1957. 100 W27S

A report was given on the saline and alkali soils under irrigation and methods used for their reclamation.

3765. Hellings, F., and Zuidberg, J. L. SUB-IRRIGATION; GENERAL REPORT. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 305-321. 1958, pub. 1960. 290.9 C765
English summary.

A discussion was given of subsurface irrigation and where and how it can be used. Subsurface irrigation is restricted to light soils in flat land of a relatively low level.

3766. Henderson, D. W. IRRIGATION MANAGEMENT ON PROBLEM SOILS. In California University Extension Division. FARM MANAGEMENT SEMINAR FOR BANK OF AMERICA OFFICERS. pp. 35-38. Davis, 1959. 281.12 C12

A discussion was given on irrigation management of problem soils in California.

3767. Herke, S. THE ROLE OF HYDROLOGICAL CONDITIONS IN THE DEVELOPMENT OF ALKALI (SZIK) SOILS BETWEEN DANUBE AND TISZA AND IN THE CHANGE OF THEIR CHARACTERISTICS. (Ge) Agrokem. es Talajtan 13(sup.): 157-164. May 1964. 385 Ag83
English summary.

3768. Hoare, E. R. DRAINAGE AND WHY IT IS NECESSARY SOME ORGANISATIONAL [ORGANIZATIONAL] PROBLEMS. In AFRICA AND IRRIGATION. Wright Rain Ltd. pp. 247-248. 1962. 55.9 W93

A report was given on the need and use of drainage of irrigated lands in Australia.

3769. Honan Sheng Shang Ch'Iu Chuan Ch'U K'O Hsueh Chi Shu Hsieh Hui. THE EXPERIENCE OF THE PEOPLE OF SHANGCHIU SPECIAL AREA IN THE IMPROVEMENT OF SALT LAND. (Ch) Chung Kuo Nung Pao. 12(260): 16-19. 1962. 22.5 C473

3770. Houston, C. E. DRAINAGE OF IRRIGATED LAND. Calif. Agr. Expt. Sta. C. 504, 40 pp. Nov. 1961. 100 C12S

Drainage systems are often complicated and expensive, but properly installed they can be made to pay off in both tangible and intangible results—better crops, soil conservation, improved health conditions, and greater convenience for the farm operator.

Many questions that come up before and during installation of drainage systems were explained.

3771. Houston, C. E. DRAINAGE OF IRRIGATED LAND; IT'S EXPENSIVE BUT CAN PAY OFF HANDSOMELY. I. World Farming. 5(5): 38-42, 44, 49-50. May 1963. 30.08 W89

A report was given on the advantages of drainage of irrigated land in California.

3772. Hseung, Y. THE PROBLEM OF SALINIZATION OF SOILS IN THE IRRIGATED AREAS OF CHINA. Pakistan J. Sci. 13(4): 164-168. July 1961. 475 P172

A report was given on the design and use of salinization measures to improve irrigated areas in China.

3773. Hsi, C. L. A DISCUSSION OF THE CRITICAL DEPTH IN THE HSIN-HSIANG YIN-HUANG IRRIGATION AREA IN HONAN. (Ch) Turang Tongbao. 2: 29-32. 1964. 56.8 T792

3774. Hsu, C. F., ed. IRRIGATION, DRAINAGE AND PLANNED WATER SUPPLY. (Ch) Peking, Chung-kuo Yeh Ch'u Pan She, 318 pp. 1963. 55 H852

3775. Ibragimov, S. LEACHING OF SALTY SOILS IN THE KHOREZM REGION. (Rus) Khlopkovodstvo. 3: 46-48. Mar. 1963. 72.8 K522

3776. Ignatenok, F. V., Timofeev, A. F., and Yakovlev, B. I. AGRICULTURAL IMPROVEMENT WORKS. (Rus) Minsk. Gosudarstvennoe Izdatel'stvo Literatury BSSR, 292 pp. 1963. 54 Ig5

3777. India Committee on Natural Resources. STUDY ON WASTELANDS INCLUDING SALINE, ALKALI AND WATERLOGGED LANDS AND THEIR RECLAMATION MEASURES. New Delhi, India. 237 pp. map. 1963. 54 In22

A study was reported of wastelands in India. Reclamation measures were given for saline, alkali, and waterlogged lands.

3778. Israelson, O. W., and Ayazi, M. INTERRELATION BETWEEN IRRIGATION AND DRAINAGE. Cong. Irrig. and Drain. Trans. 3(5): 10.221-10.242. map. 1957. 55.9 C7652

A discussion was given on the interrelationship between irrigation and drainage in Iran. The need for drainage of irrigated soils depends on the depth of the irrigation water applied, the climate, depth of rainfall, and soil properties both physical and chemical.

3779. Israelson, O. W., and Hansen, V. E. IRRIGATION PRINCIPLES AND PRACTICES. Ed. 3. John Wiley and Sons, Inc., N.Y. 447 pp. 1962. 55 Is7 Ed3

This revised textbook on irrigation has several chapters on drainage requirements, pump drainage, drainage conveyance, salt problems, salt reclamation, and legal aspects on drainage.

3780. Jain, J. K. HYDROLOGICAL ASPECTS OF THE SALT PROBLEMS IN AGRICULTURE AND ITS CONTROL THROUGH IMPROVED WATER MANAGEMENT IN ARID AND SEMI-ARID REGIONS (WITH REFERENCE TO PROBLEMS IN INDIA). United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 11-116. Ref 1961. 278.9 Un3

A discussion was given of the salt problem in India and how it has been solved by the following water management practices: (1) Irrigation; (2) leaching; and (3) drainage.

3781. Janert, H. SUBSURFACE IRRIGATION. Oesterr. Wasserwirt. 8(3): 72-77. Mar. 1956. 55.8 Oe8

3782. Jelinek, J. THE UTILIZATION OF DRAINAGE CANALS IN THE IRRIGATION. (Cz) Za Vysokou Urodu. 11(7): 272. 1963. 64.8 Z12

3783. Jones, G. O. RECLAMATION OF "SALTY" LAND IN THE KERANG DISTRICT. J. Agr. [Melbourne] 60(10): 453-457. Oct. 1962. 23 V66J

A report was given of reclamation methods used successfully for the reclamation of "salty" land in the irrigated area of the Kerang district of Australia.

3784. Joshi, K. V. IRRIGATION, WATERLOGGING AND DRAINAGE. Nagpur Agr. Col. Mag. 36(2): 16-24. map. 1962. 107.5 N132

A report was given on the relationship of irrigation, waterlogging, drainage, salinity, and malaria in India.

3785. Kadyrov, R. S. INTERFARM COLLECTING-DRAINAGE NETWORK CONSTRUCTED ON IRRIGATED AREAS OF KHOREZM REGION. (Rus) Gidrotekh. i Melior. 1962(5): 11-22. map. May 1962. 290.8 G362

3786. Kadyrov, R. S. IMPROVEMENT OF SOILS IN KHOREZM REGION. (Rus) Gidrotekh. i Melior. 6: 3-9. June 1964. 290. G362

3787. Kalantaev, V. DAILY ATTENTION TO THE IMPROVEMENT OF LANDS. (Rus) Sel'sk. Khoz. Turkmenistana. 2: 51-54. Mar./Apr. 1962. 20 Se 4982

3788. Karianov, N. A. FURROW-TERRACE METHOD OF GROWING IRRIGATED VEGETABLE CROPS. (Rus) In DOSTIZHENIIA OVOSHCHEVODOV; SBORNIK STATEI. Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury. pp. 109-118. 1957. 91 D74

3789. Karimov, T. SOIL PREPARATION FOR LEACHING IN CENTRAL FERGANA. (Rus) Khlopkovodstvo. 9: 31-33. Sept. 1964. 72.8 K522

3790. Kelley, W. P. MAINTENANCE OF PERMANENT IRRIGATION AGRICULTURE. Soil Sci. 98(2): 113-117. Aug. 1964. 56.8 So3

The prevention of soil salinization due to high water by drainage and leaching was discussed.

3791. Kerr, F. F., and Lund, R. SOILS, WATER, DRAINAGE OF THE WAGNER, TOWER, AND GREENWOOD IRRIGATION UNITS. S. Dak. State Col. Agr. Ext. F.S. 168, 4 pp. map. Aug. 1963. 275.29 So85Fs

An illustrated ginde was given on surface drainage and subsurface drainage of irrigated land in South Dakota.

3792. Khavroshchenko, V. PROBLEMS OF IRRIGATION AND RECLAMATION ARE TO BE SOLVED JOINTLY. (Rus) Narod. Khoz. Uzbek. 1962(4): 37-38. Apr. 1962. 280.8 N164

3793. Kichigin, V. N. SUBSURFACE IRRIGATION. (Rus) Gidrotekh. i Melior. 10(2): 14-21. Feb. 1957. 290.8 G362

3794. Kichigin, V. N. ECONOMIC EXPEDIENCY OF UTILIZING SUBSURFACE IRRIGATION. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 13(5): 51-55. Sept./Oct. 1958. 80 Sa15

3795. Kichigin, V. N. LOWERING THE COSTS OF INSTALLING SUBSOIL IRRIGATION SYSTEMS. (Rus) Sadov. Vinograd. i Vinodel. Moldavii. 1959(4): 61-65. July/Aug. 1959. 80 Sa15

3796. Kim, A. G. SOME METHODS OF THE RECLAMATION OF SOILS IN BUKHARA. (Rus) Khlopkovodstvo. 9: 42-45. Sept. 1962. 72.8 K522

3797. King, A. L. DRAINAGE, A VITAL NEED IN IRRIGATED HUMID AREAS. J. Irrig. and Drain. Div., ASCE 86(IR 4): 81-100. Dec. 1960. 290.9 Am3Ps

A report was given on the need of drainage for irrigation in humid areas.

3798. King, A. L. DRAINAGE, A VITAL NEED IN IRRIGATED HUMID AREAS. Amer. Soc. Civil Engin. Trans. 126(3): 472-491. 1961. 290.9 Am3

Total rainfall in humid areas appears to be adequate for almost all purposes. The rainfall pattern, however, is constantly varying and unpredictable. The variability in amount, rate of fall, and time of rains causes droughts on the one hand and flooding of level lands on the other. Supplemental irrigation solves the problem created by droughts, while adequate drainage systems offer a solution to the drainage problem. Where supplemental irrigation is practiced, drainage is as important a factor as the provision of water for crops.

3799. King, R. D. PUT YOUR LAND TO GRADE; IMPROVED DRAINAGE AND MORE UNIFORM IRRIGATION RESULT FROM THIS COSTLY, BUT USUALLY PROFITABLE, FIELD LEVELING PRACTICE. Doane's 27(11): 30-31. Apr. 8, 1964. 281.8 D652.

A report was given on the use of land leveling to improve drainage and irrigation.

3800. Kireev, A. F. RECLAMATION OF COMPLEX SOLONETZ SOILS IN THE SOUTHEAST. (Rus) Zhivotnovodstvo. 12(3): 35-37. Mar. 1958. 49 Z6

3801. Kiselev, M. V. DEVELOPMENT OF DRAINAGE IN IRRIGATED AREA OF BUKHARA REGION. (Rus) Gidrotekh. i Melior. 5: 10-16. May 1964. 290.8 G362

3802. Kiseleva, I. K. RECLAMATION OF SALTY SOILS OF THE GOLODNAYA STEP. (Rus) Khlopkovodstvo. 1: 39-41. Jan. 1963. 72.8 K522

3803. Kizilova, A. A. MOVEMENT OF EASILY SOLUBLE SALTS IN SOLONCHZK SOILS UNDER LEACHING. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 227-237. Ref. 1961. 278.9 Un3

A review was given of field experiments on the movement of easily soluble salts in Solonchak soils under leaching in the U.S.S.R.

3804. Klychnikov, V. M. RECLAMATION OF SALINE LANDS IN CHINA. (Rus) Nauka i Peredovol Opyt v Sel'sk. Khoz. 1956(7): 89-90. July 1956. 20 N222

3805. Koike, Y., Nakahara, M., and Yoshino, M. UTILIZATION OF GROUND DRAINAGE FOR DESALINIZATION. (Ja) Saga. Agr. Expt. Sta. B. 3: 23-25. Mar. 1962. 107.6 SalK

3806. Konakov, M. K. IMPROVEMENT AND UTILIZATION OF SALINE AREAS IN FLOOD-LANDS IN VOROSHILOVGRAD REGION FOR GROWING OF VEGETABLES AND POTATOES. (Rus) Voroshilovgrad. Sel'skokhoz. Inst. Nauch. Zap. 4(2): 86-91. 1957. 106 V916

3807. Kovda, V. A. THE USE OF DRAINAGE TO PREVENT SALINIZATION OF IRRIGATED SOILS. Cong. Irrig. and Drain. Trans. 3(5): 10.205-10.220. 1957. 55.9 C7652

A report was given on the use of drainage in the U.S.S.R. to prevent salinization of irrigated soils.

3808. Kovda, V. A. SALINITY PROBLEMS OF IRRIGATED SOILS IN EGYPT. Inst. du Desert d'Egypte. P. 11: 3-60. 1958. 515 In7P

A report was given on the genius and classifications of saline soils in irrigated areas in Egypt and their prevention and reclamation.

3809. Koyama, T., Musha, T., and Ito, E. STUDIES ON IRRIGATION AND DRAINAGE TREATMENT. III. STUDIES ON CHANGING ILL-DRAINED PADDY FIELD TO WELL-DRAINAED PADDY FIELD. (Ja) (Abs.) Crop Sci. Soc. Japan. Proc. 25(4): 235. July 1957. 22.5 C88

3810. Kriel, A. F. THE IRRIGATION OF ALKALINE SOIL. (Af) Wynboer. 33(389): 17-18. Feb. 1964. 390.8 W 724

3811. Kristensen, E. A NOTE ON WATER CONTROL IN DENMARK. Internatl. J. Agr. Aff. 3(1): 37-40. Jan. 1961. 281.8 In82

A report was given on the history and present use of water control in Denmark for drainage, irrigation, and reclamation.

3812. Krohn, J., and Mahn, F. TECHNICAL HELP FOR BLUEBERRY GROWERS FROM THE SOIL CONSERVATION SERVICE. N.J. Agr. Expt. Sta. Annu. Blueberry Open House. Proc. 30: 10-11. 1962. 94.35 N46A

A report was given on the use of drainage and water control for blueberries in New Jersey.

3813. Krzywonos, K. INVESTIGATIONS ON WATER LOSSES IN THE IRRIGATION SYSTEM OF KUWASY PEAT BOG. (Pol) Warsaw. Inst. Melior. i Uzytkow Zielonych. Wiad. 3(3): 57-74. 1963. 54.9 W262W

3814. Kulkarni, D. G. RECLAMATION OF WATERLOGGED LANDS IN BOMBAY-DECCAN. Cong. Irrig. and Drain. Trans. 4(3): 11.693-11.717. maps. 1960. 55.9 C7652

A report was given on the reclamation of waterlogged land in an irrigated area (Bombay-Deccan) in India.

3815. Kuznets, J. M. DRAINAGE-IRRIGATION SYSTEMS IN THE UKRAINIAN SOVIET SOCIALIST REPUBLIC. Cong. Irrig. and Drain. Trans. 5(5): R.17.255-R.17.266. 1963. 55.9 C7652

A report was given on drainage-irrigation systems in Ukrania.

3816. Kuznetsov, N. I. SOME PROBLEMS OF IMPROVEMENT OF SALINIZED SOILS OF THE CENTRAL FERGANA VALLEY. (Rus) Khlopkovodstvo. 10: 41-44. Oct. 1962. 72.8 K522

3817. Laktionov, B. I. NATURE OF THE HIGH DISPERSITY OF SOLONETZIC SOILS AND METHODS FOR THEIR CHEMICAL MELIORATION. (Rus) Pochvovedenie. 6: 78-87. June 1962. 57.8 P34A
English translation—Soviet Soil Sci. 6: 635-642. June 1962. 57.8 P34Ae

The nature of high dispersity of solonetic soils was studied and the methods for their chemical melioration were given.

3818. Laptev, V. N. ESTABLISH A MAJOR BASIS OF RICE PRODUCTION IN THE ASTRAKHAN REGION. (Rus) Sel'sk. Khoz. Povolzh'ya. 1961(2): 42-46. Feb. 1961. 20 Se478

3819. Larson, N. G. PHOTOGRAMMETRY—ITS USE TO DETERMINE DROUGHT, SALINITY OF SOIL, AND PLANT DISEASES; A PRELIMINARY LIST OF REFERENCES. Washington, U.S. Nat. Agr. Libr., 1964. 2 pp. 1964. VF Bibliogr.

An annotated bibliography was given of article written on Photogrammetry for the determination of drought, salinity of soil, and plant diseases.

3820. Lastochkin, D. S. STRENGTHENING OF MOLE DRAINS FOR SUBSURFACE IRRIGATION AND DRAINAGE. (Rus) Gidrotekh. i Melior. 10: 25-29. Oct. 1964. 290.8 G362

3821. Lauciani, E. LAND RECLAMATION AND IRRIGATION. (It) Irrig. a Pioggia. 3(3): 260-265. Sept. 1956. 55.8 Ir733
English summary.

A discussion was given on the principles to be applied to obtain good soil structure by: Surface improvement; drainage; and proper irrigation in Italy. A drainage system proposed by Giulio Del Pelo Pardi was discussed and illustrated.

3822. Lee, S. M. THE SYSTEM OF IRRIGATION AND DRAINAGE FOR SUGARCANE FIELD IN THE TOWLIU SUGAR MILL. Taiwan Sugar. 8(8): 23-28. Aug. 1961. 65.8 T133

The system of irrigation and drainage for a sugarcane field of the Towliu Sugar Mill in Taiwan was described and illustrated that can be used on flat lands and sloping lands.

3823. Legostaev, V. M. LEACHING OF SALTY LANDS BY IRRIGATION. (Rus) Khlopkovodstvo. 7(10): 19-22. Oct. 1957. 72.8 K522

3824. Legostaev, V. M. SOIL RECLAMATION ON THE GOLODNAYA STEPPE. (Rus) Pochvovedenie. 1958(1): 13-26. Ref. Jan. 1958. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 1: 13-26. Ref. Jan. 1958. 57.8 P34Ae

Reclamation methods were given concerning the application of complex measures to prevent soil salinization in the Golodnaya Steppe region.

3825. Legostaev, V. M. CONTROL OF SOIL SALINITY WITH THE HELP OF VERTICAL DRAINAGE. (Rus) Khlopkovodstvo. 1961(9): 47-56. Sept. 1961. 72.8 K522

3826. Legostaev, V. M. IMPROVEMENT OF SALTY SOILS. (Rus) Tashkent. Nauch.-Issled. Inst. po Khlopkov. Trudy. 2: 7-29. 1962. 72.9 T182T

3827. Lerner, S. PAKISTAN TO RECLAIM ITS WATERLOGGED LAND. Foreign Agr. 25(10): 17-18. map. Oct. 1961. 1.9 Ec7For

A report was given on the need of drainage of irrigated lands in Pakistan due to salinity and high water tables.

The plan for a project was given where tubewells are to be used to lower the water table and supply water for irrigation. The water table in the area has risen from 80 to 100 feet from the surface to 5 to 15 feet.

3828. Letunov, P. A. SOIL MELIORATION PROBLEMS OF IRRIGATED AGRICULTURE. (Rus) Pochvovedenie. 1: 7-11. Jan. 1964. 57.8 P34
English translation—Soviet Soil Sci. (1): 4-6. Jan. 1964. 57.8 P34Ae

A report was given on the use of drainage and leaching to improve irrigated agriculture in the U.S.S.R.

3829. Levakov, V. DRAINAGE WORK ON MARSHY AND SALT-RIDDEN LANDS UNDER IRRIGATION. (Rus) Sel'sk. Khoz. Kazakhstana. 6(8): 68-69. Aug. 1959. 20 K185

3830. Lewis, M. R. WATER-TABLE CONTROL; THE FUNCTION OF DRAINAGE OF IRRIGATED LAND. Cong. Irrig. and Drain. Trans. 4(2): 11.129-11.137. Ref. 1960. 55.9 C7652

A discussion was given of the function of drainage of irrigated lands for water table control in arid and semi-arid zones where salinization is an important factor.

3831. Li, L. C., and Hsin, T. C. DEVELOPMENT OF IRRIGATED FARMING AND THE SALINE SOIL IMPROVEMENT REGIONS IN HOTAO DISTRICT IN INNER MONGOLIA. (Ch) Zhongguo Nongye Kexue. 4: 14-21. Apr. 1964. 22.5 N928

3832. Lifshits, E. A. THE EFFECT OF CULTURAL METHODS ON IMPROVEMENT OF SALTY SOILS. (Rus) Khlopkovodstvo. 8: 26-28. Aug. 1964. 72.8 K522

3833. Lindqvist, R. DO THE IRRIGATION DITCHES FUNCTION BADLY? (Sw) Malmohus Lans Hushallsk. Kvrtlskr. 1957(2): 231-235. 1957. 11 M29

3834. Loehnberg, A. WATER SUPPLY AND DRAINAGE IN SEMI-ARID COUNTRIES. Amer. Geophysical Union Trans. 38: 501-510. 1957. 330.9 Am3

Drainage cannot be separated from water supply for land development in hill-plain border regions of semi-arid countries.

If it is desired to irrigate a maximum area of land, a priority of sequences must be fixed at an early stage for the measures taken to exploit successively the total inventory of surface and subsurface waters. A general scheme of priorities established the following precedences: (1) Water supply before drainage and flood control; (2) use of subsurface before surface waters; (3) abstraction from foreland ground-water horizons before mountain ground water; (4) development of hill before valley springs; and (5) use and creation of underground storage before surface storage.

3835. Lofton, K. T. SALINITY PROBLEMS IN THE TRANS-PECOS AREA OF TEXAS. Sheep and Goat Raiser. 42(3): 26, 28. Dec. 1961. 45.8 Sh3

Some salinity problems of the Trans-Pecos Area of Texas were discussed. Results of conservation practices used in the area to help control these salinity problems were described and illustrated.

3836. Long, A. A., and Webster, A. SURFACE AND SUBSURFACE DRAINAGE INVESTIGATIONS IN THE CENTRAL GIPPSLAND IRRIGATION DISTRICT VICTORIA. Cong. Irrig. and Drain. Trans. 4(2): 11.97-11.113. maps. 1960. 55.9 C7652

Current surface and subsurface drainage investigations were described for an irrigated area in Australia. Systems used to calculate runoff for the design of drainage systems were discussed. The ground water fluctuations since the introduction of irrigation were described.

3837. Lopatnik, J. MEASURES OF RECLAMATION TO BE UNDERTAKEN AFTER THE CHEMICAL MELIORATION OF SALINE SOILS. III. (Cz) Czech. Min. Zemedel. Les. Vodn. Hospodar. Ustav. Vedeckotech. Inform. Rostlinna Vyroba. 36(12): 1275-1282. Dec. 1963. 64.9 C33
German summary.

3838. Lubianyi, N. I. EXPERIENCE IN OPERATION OF THE TRUBEZH RIVER DRAINAGE AND IRRIGATION SYSTEM. (Rus) Gidrotekh. i Melior. 1960(2): 16-18. Feb. 1960. 290.8 G362

3839. Lyerly, P. J., and Longenecker, D. E. SALINITY CONTROL IN IRRIGATION AGRICULTURE. Tex. Agr. Expt. Sta. B. 876, 20 pp. Aug. 1957. 100 T31S

A report was given on salinity control methods in irrigated agriculture in Texas.

3840. McKeag, J. A. ONE DITCH SYSTEM. Reclam. Era. 45(3): 61-62, 79. Aug. 1959. 156.84 R24

A report was given on a one ditch system for both irrigation and drainage in California.

3841. McKeag, J. A. THE ONE-DITCH SYSTEM. Irrig. Engin. and Maintenance. 9(11): 8-9. Oct. 1959. 55.8 Ir722

A report was given of a single system used for irrigation and drainage in California. Originally it was set up for high water tables in swamp and overflow lands.

3842. Maianu, A. RESEARCH ON SECONDARY SALINIZATION OF CERTAIN DAMMED-UP AND IRRIGATED SOILS OF THE FLOOD ZONE OF THE DANUBE. (Rum) Bucharest Inst. Cent. Cercet. Agr. Sect. Pedol. An. Ser. A, 30: 193-213. map. Ref. 1962, pub. 1963. 21 R86A
French summary.

3843. Maianu, A. STUDY OF THE PROCESS OF SECONDARY SALINIZATION OF SOIL IN RICE PARCELS DISPOSED IN TERRACES: METHODS OF PREVENTION AND CONTROL. (Rum) Bucharest Inst. Cent. Cercet. Agr. Sect. Pedol. An. Ser. A, 30: 215-235. map. Ref. 1962, pub. 1963. 21 R86A
French summary.

3844. Maianu, A. MEASURES FOR PREVENTING SECONDARY SALINIZATION OF SOIL. (Rum) Prob. Agr. [Bucharest] 15(1): 90-97. Ref. Jan. 1963. 21 R862

3845. Maianu, A. SECONDARY SOIL SALINIZATION. Bucuresti, Editura Acad. Repub. Pop. Romine. 426 pp. map. Ref. 1964. 56.4 M28

3846. Maierhofer, C. R. DRAINAGE IN RELATION TO A PERMANENT IRRIGATION AGRICULTURE. Proc. Intersociety Conf. on Irrig. and Drain. 1957. 1: 101-106. 1959.

A report was given on the need for drainage for a permanent irrigation agriculture.

3847. Maierhofer, C. R. DRAINAGE IN IRRIGATION—A WORLD PROBLEM. I. Reclam. Era. 48(3): 73-76. Aug. 1962. 156.84 R24

A report was given on the early history of drainage in irrigation throughout the world and how a lack of knowledge of irrigation helped bring the downfall of early civilizations.

3848. Maierhofer, C. R. DRAINAGE IN IRRIGATION—A WORLD PROBLEM. II. Reclam. Era. 48(4): 103-105. Nov. 1962. 156.84 R24

A continuation was given on a history of drainage throughout the world along with a discussion of the steps taken in modern times to keep soil from becoming waterlogged and salinized.

3849. Makhno, G. F. LEACHING IRRIGATION OF FOREST PLANTINGS IN THE KHOREZM OASIS. (Rus) Lesn. Khoz. 12: 49-52. Dec. 1964. 99.8 L5622

3850. Maksimiuk, G. P. THE SALT REGIME OF THE SOLONCHAK SOLONETZ SOILS AND ITS CHANGE DURING RECLAMATION. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy. 38: 83-98. 1958. 99.9 Ak1

3851. Maksimyuk, G. P. AN EXPERIMENTAL STUDY OF THE LEACHING PROCESS OF SOLONCHAK-LIKE SOLONETZES. (Rus) Pochvovedenie. 8: 18-28. Aug. 1958. 57.8 P34
English translation—Soviet Soil Sci. 8: 836-843. Aug. 1958. 57.8 P34Ae

The processes of desalinization and desolonetzization of solonchak-like solonetzes by means of deep plowing and additional watering were studied in the U.S.S.R.

Solonchak-like solonetzes, even virgin, were characterized by a relatively high intake rate. During leaching, uneven wetting of the soil profile, owing to cracks, was observed at the beginning.

Deep plowing, which brings gypsum up into the cultivated layer, increased the water intake rate approximately 4 times. During leaching the intake rate decreased; this was explained by soil swelling, by closing of the cracks and by the compaction of the subsolonetz horizon when easily soluble salts were leached from it. Even at the end of leaching, however, the intake rate remained higher in plowed solonetzes.

3852. Malaika, J. IRRIGATION CONDITIONS AND PROBLEMS IN IRAQ. Near East-S. Afr. Irrig. Pract. Seminar. [Proc.] 5: 119-125. map. 1964. 173.2 In8Reg

A report was given on irrigation conditions and problems in Iraq. The need of drainage for irrigated lands and for salinity control was noted.

3853. Malygin, V. S. CERTAIN MEASURES IN RECLAMATION OF SALINE SOILS OF GOLODNAIA STEPPE. (Rus) In Uzbekistan. SOVET PO IZUCHENIIU PROIZVODITEL'NYKH SIL. GOLODNAIA STEP'. Tashkent, pp. 139-146. 1957. 54 Uz1

3854. Marcus, G. WATER FROM THE ROCKS. (Sw) Mjolkpropagandan. 37(3): 64-65. 1960. 44.8 M692

3855. Martinez, L. A. PROBLEMS OF SALINITY IN THE IRRIGATION DISTRICT, JUAREZ VALLEY, CHIHUAHUA. (Sp) Ingen. Hidraul. en Mex. 12(1): 11-19. map. Jan./Mar. 1958. 290.8 In43

3856. Martinez, L. A., and Benitez-Lopez, E. STUDY OF THE NITROUS CONDITIONS AND DRAINAGE FOR SOIL RECLAMATION AT THE MIOQUI EJIDO, STATE OF CHIHUAHUA. (Sp) Ingen. Hidraul. en Mex. 15(3): 51-60. July/Sept. 1961. 290.8 In43
English summary.

A report was given on the drainage and irrigation requirements for reclaiming soils containing saltpeter in Mexico.

3857. Maslov, C. S. ON RATES OF DRAINAGE AND IRRIGATION OF BOGGY LOWLANDS. (Rus) Gidrotekh. i Melior. 1: 31-38. Jan. 1963. 290.8 G362

3858. Mathey, N. A. THESE IRRIGATION FARMERS RESTORE ALKALI LANDS. Soil Conserv. 29(6): 142-143. 1964. 1.6 So3S

A report was given on the use of land leveling and leaching plus gypsum for restoring alkali land in Arizona.

3859. Matsubara, S. ON THE THEORETICAL STUDIES FOR WATER-REQUIREMENT IN PADDY FIELD POLLUTED WITH SALTS IN CONNECTION WITH THE STUDIES OF THE COASTAL GROUND WATER. (Ja) Nogyodoboku-Kenkyu. 26(3): 135-139. Sept. 1958. 290.8 N68

3860. Mavrocordat, G., Nicolau, M., and Atanasiu, G. EXPERIMENTAL STUDY OF THE IMPROVEMENT OF ALKALI SOILS. (Rum) Bucharest Acad. Repub. Pop. Romine. Filiala Ciuj. Studii si Cercet. de Agron. 14: 49-63. 1963, pub. 1964. 21 B854
English summary.

A report was given on the use of phosphogypsum and calcic chloride to improve alkali soils in Rumania by leaching. The calcic chloride was the most effective.

3861. Mazloum, S. REPORT ON THE REGIONAL CONFERENCE ORGANISED BY FAO AT TEHERAN (IRAN) BETWEEN 6 and 13 NOVEMBER, 1954 ON IRRIGATION AND DRAINAGE PRACTICES IN THE NEAR EAST. Internatl. Comn. Irrig. and Drain. Annu. B. 1955: 114-129. 1955. 55.9 In8A

A report was given on the regional conference organized by FAO at Teheran (Iran) Nov. 6-13, 1954 on irrigation and drainage practices in the Near East.

3862. Mehta, M. L. THE BEHAVIOUR OF THE SUBSOIL WATER TABLE UNDER THE PUNJAB CANALS. Cong. Irrig. and Drain. Trans. 3(5): 10.71-10.102. maps. Ref. 1957. 55.9 C7652

A report was given on the subsoil water table under the Punajab irrigation canals in India. The need was given for drainage to restore waterlogged lands to cultivated lands. The use of pump drainage was stressed where gravity drainage was not successful to avoid the accumulation of salts at the soil surface.

3863. Mendizabal, M., and Verdejo, G. A METHOD OF USING SALINE SOILS TO BEST ADVANTAGE: SANDBED CULTURE. (Fr) United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 16: 323-326. 1961. 278.9 Un3
English summary.

A report was given on the use of sand-bed cultivation in Spain to use saline soils to the best advantage. The land is first prepared (by plowing or digging) and fertilized with mineral fertilizers as needed. A layer of farmyard manure is then applied and a layer of well-washed sand (preferably sea sand) is applied on top of the manure. The crop is then sown or transplanted in the sand being careful not to mix the layers of sand, manure, and soil.

3864. Merrill, C. L., and Hatch, W. B. UTAH IRRIGATED AREA PROFITS FROM MODERN SOIL-WATER MANAGEMENT. Soil Conserv. 29(3): 62-63. 1963. 1.6 So3S

A report was given on the value of soil conservation practices for soil-water management in irrigated areas in Utah.

3865. Meyer, C. B. WATER CONSERVATION AND DRAINAGE OF IRRIGATED LANDS UNDER THE CALIFORNIA WATER PLAN. Calif. Mosquito Control Assoc. Proc. and Papers. 25: 4-6. June 30, 1957. 428 C763

A report was given on water conservation and drainage of irrigated lands under the California Water plan.

3866. Mikhailichenko, V. N. THE AGRICULTURAL-RECLAMATION CHARACTERISTICS OF SOLONETZ SOILS OF THE SOLONETZ STATION ON THE NEZHINSKII STATE FARM. (Rus) Akad. Nauk Kazakhskoi SSR. Inst. Pochvoved. Trudy. 11: 127-153. Ref. 1960. 56.9 AL6

3867. Milev, V. ON THE QUESTION OF LEVELLING THE RICE FIELDS. (Bu) Selskostopanska Nauka. 10: 1063-1067. 1962. 21 Se492
English summary.

A report was given of the use of levelling of rice fields in Bulgaria for surface drainage and irrigation.

3868. Miller, H. W., Hoglund, O. K., and Hafenrichter, A. L. GRASSES, LEGUMES, AND CULTURAL METHODS FOR IMPROVING PASTURE PRODUCTION AND AIDING CONSERVATION ON SALINE-ALKALI LAND. Calif. Dept. Nat. Resources, Div. Soil Conserv. B. 1, 24 pp. 1959. 56.9 C124

Cultural methods and species for the conversion of low-producing native cover to improved irrigated pasture on fine-textured saline-alkali soils were studied in the San Joaquin Valley of California.

The site was plowed, leveled, treated with two rates of gypsum and with gypsum and manure, ponded, and flushed. Then it was allowed to dry, was releveled, bordered, preirrigated, and a fine firm seedbed was prepared in the early fall. A selected pasture mixture of Goars fescue, (Festuca arundinacea var. aspera), and narrowleaf trefoil, (Lotus corniculatus var. tenuis), was diluted with rice hulls, treated with fungicide, inoculated, and seeded with a double disk grain drill.

3869. Minshina, N. G. SALINIZATION AND REAUIRED MELIORATION OF ANCIENT IRRIGATED SOILS IN THE KARA-KUM CANAL ZONE. (Rus) Pochvovedenie. 2: 9-20. Ref. Feb. 1964. 57.8 P34. English translation—Soviet Soil Sci. 2: 111-120. Ref. Feb. 1964. 57.8 P34Ae

A report was given on the salinization of ancient irrigated soils in the Kara-Kum Canal Zone and their need for drainage and leaching for salinity control.

3870. Mingalieva, A. Z. RECLAMATION OF SOLONCHAK SOILS BY LEACHING AND SUBSOILING. (Rus) Khlopkovodstvo. 1: 36-38. Jan. 1963. 72.8 K522

3871. Misra, S. G. EFFECT OF LEACHING SOILS WITH DIVALENT CATIONS. Soil Sci. and Plant Nutr. 7: 87-89. 1961. 56.8 So38

When an alkali soil is repeatedly leached with dilute solutions of calcium chloride, magnesium chloride, and calcium sulphate, the exchange-complex is enriched with respect to divalent cations, Ca^{++} and Mg^{++}, while the monovalent cations, Na^{+} and K^{+}, greatly decrease leading to a distinct and sudden fall in pH value of the alkali soil. The normal soil, good soil, and the garden soil, however, showed no such effect. Only the exchangeable magnesium increased as a result of leaching with a dilute solution of magnesium chloride.

3872. Mohammad, G. WATERLOGGING AND SALINITY IN THE INDUS PLAIN: A CRITICAL ANALYSIS OF SOME OF THE MAJOR CONCLUSIONS OF THE REVELLE REPORT. Pakistan Devlpmt. Rev. 4(3): 357-403. Ref. Autumn 1964. 280.8 P17

An analysis was given of some major conclusions on the Revelle Report "on waterlogging and salinity" in West Pakistan.

3873. Mohan, Y. IRRIGATION AND DRAINAGE IN THE THIRD FIVE YEAR PLAN OF INDIA. Internatl. Comn. Irrig. and Drain. Annu. B. 1961: 115-117. 1961. 55.9 In8A

A report was given of the third five year irrigation drainage plan for India.

3874. Moinuddin, M. WE WILL RECLAIM THE "HEBBA_HALLA" LANDS. Indian Farming. 7(11): 33-34. Feb. 1958. 22 In283

The reclamation of highly eroded alkali soil for rice culture was discussed for India. The area was plowed, leveled, and drained by deep open ditches. The soil was treated with 10 tons of cane molasses and 35 tons of filter press cake. Compost and/or good soil was added to the soil.

3875. Molen, W. H. Van Der. DESALINIZATION OF SALINE SOILS AS A COLUMN PROCESS. Soil Sci. 81: 19-27. Ref. Jan. 1956. 56.8 So3

The desalinization of soil profiles observed after the inundations of 1944-45 in the southwestern part of the Netherlands were compared with the Gleckand theory of column operation. A good qualitative agreement between observations and theory was found, even for nonhomogeneously saline profiles.

3876. Molof, J. J. DRAINAGE IN THE IMPERIAL VALLEY OF CALIFORNIA. J. Soil and Water Conserv. 16(6): 267-269. Nov./Dec. 1961. 56.8 J822

Drainage is one of the most important factors in maintaining high productivity on farmlands in southern California's Imperial Valley. Land leveling, crop rotations, fertilizer application, and irrigation water management are also needed.

The partial answer to the drainage problem appears to be the installation of tile drains. Cost of tile installation varied from $50 to $200 per acre. Many tile drainage systems paid for themselves during the first year or two of use

3877. Molof, J. J. DRAINAGE, IMPERIAL VALLEY, CALIFORNIA. Holly Agr. News. 10(2): 9-11. Summer 1962. 66.8 H72

A report was given on the drainage practices in Imperial Valley in California.

3878. Morozov, A. T. DRAINAGE IN IRRIGATED REGIONS AS REGULATOR OF WATER-SALT REGIME OF SOILS. (Rus) In Pochvennyi Institut imeni V. V. Dokuchaeva. MELIORATSIYA POCHV KURA-ARAKSINSKOI NIZMENNOSTI. pp. 3-106. map. Ref. 1962. 54 P753Me

3879. Morozov, V. K. SUBSURFACE IRRIGATION. (Rus) Sadovodstvo. 1961(7): 27-28. July 1961. 80 Sa13

3880. Mukhamedgaliev, K. M. ABOUT LEACHING AND DRAINAGE IN RECLAMATION OF SALTY SOILS. (Rus) Akad. Nauk Kazakhskoi SSR. Vest. 10: 89-90. Oct. 1962. 511 AL6

3881. Muratova, V. S. TRANSLOCATION OF SALTS DURING IRRIGATION OF THE MILI LOWLAND. (Rus) In Pochvennyi Institut imeni V. V. Dokuchaeva. MELIORATSIYA POCHV KURA-ARAKSINSKOI NIZMENNOSTI, pp. 107-184. map. Ref. 1962. 54 P753Me

3882. Muravsky, E. SOIL SALINITY PROBLEMS; CURRENT ISRAELI RESEARCH PROJECTS. Cong. Irrig. and Drain. Trans. 4(6): C.397-C.403. 1960. 55.9 C7652

A report was given on current research projects in Israel on soil salinity problems.

3883. Murthy, A. S. S. CAUSES OF WATER-LOGGING ALKALI SOILS FORMATION IN THE N. S. F. ZONE AND THE NEED FOR A COMPREHENSIVE DRAINAGE SCHEME. Deccan Sugar Technol. Assoc. (India). Annu. Conv. 14(1): 41-46. 1957. 65.9 D35

Needs for drainage in an area of waterlogged alkali soils in India were given.

3884. Myers, L. E. SOIL AND WATER MANAGEMENT IN RELATION TO MOSQUITO CONTROL. Calif. Mosquito Control Assoc. 24: 11-13. 1956. 428 C763

In 1955, U.S. Public Health Service and Agricultural Research Service cooperative field studies were initiated in the Milk River Valley, Montana, to determine if improved fertilization and irrigation practices could be developed which would increase bluejoint (*Agropyron smithii*) yields on heavy Bowdoin clay soils and at the same time decrease mosquito production. Results indicated that a five-fold increase in bluejoint yields was possible when heavy fertilized with nitrogen and 60 percent of the available moisture within the root zone was allowed to deplete prior to irrigation. Mosquito production under these conditions was eliminated, whereas adjacent flooded borders representing former irrigation practice in the area produced an abundance of *Aedes* and *Culex tarsalis* mosquitoes.

3885. Myers, V. I. WATER CONSERVATION RESEARCH FOR LIMITED IRRIGATION WATER SUPPLIES. Proc. Annu. Nevada Water Conf. 17: 3-11. 1963.

Water conservation research results indicated that there were many opportunities for conserving and using irrigation water supplies more efficiently. Some of these are: (1) Improving prediction and use of precipitation; (2) utilizing soil moisture more efficiently; (3) reducing evaporation and transpiration; (4) improving irrigation efficiencies; (5) fertilizing to make more efficient use of water; (6) reclaiming saline soils; (7) using low quality water; (8) using water from high water tables; and (9) modifying soil profiles for improved water intake, storage, and plant root development.

3886. Myers, V. I., Ross, P. E., and Carter, D. L. IRRIGATION, SALINITY, AND DRAINAGE. Tex. Agr. Expt. Sta. B-1002: 8-11. Dec. 1963. 100 T31S

A report was given on the need of drainage and salinity control in irrigated citrus orchards in Texas.

3887 Nagata, T., and Ogayu, K. EFFECTS OF INCORPORATION OF CLAYS ON SAND DUNE IN SHIZUOKA PREFECTURE. (Ja) J. Sci. Soil and Manure. 32(3): 101-103. 1961. 56.8 J27
English abstract—Soil Sci. and Plant Nutr. 7(1): 42. July 1961. 56.8 So38

Studies in Japan were reported on the effect of clays added to sand dune material on rice yields under drained conditions.

3888. Najim, H. T. DISTRIBUTION OF SALT AND SILT IN IRAQ AGRICULTURE. Diss. Abs. 21(9): 2671. Mar. 1961. 241.8 M58

An abstract was given on the distribution of salt in the irrigation fields and silt in the canals in Iraq.

3889. Narbaev, K. LEACHING OF ALLUVIAL SOLONCHAK SOILS OF CENTRAL TIEN SHAN AREA. (Rus) Akad. Nauk Kirgizskoi SSR. Izv. Ser. Biol. Nauk. 4(6): 81-87. Ref. 1962. 442.9 Ak123

3890. Nath, B. RECLAMATION OF SUBMERGED AND MARSHY LANDS AND CHECK ON GROUND WATER RISE IN SARDA CANAL AREA IN UTTAR PRADESH. Cong. Irrig. and Drain. Trans. 4(3): 11.659-11.672. maps. 1960. 55.9 C7652

A report was given on the reclamation by drainage of submerged and marshy lands affected by the Sarda Irrigation Canal in Uttar Pradesh in India.

3891. National Reclamation Association. PROCEEDINGS OF THE TWENTY-FOURTH ANNUAL MEETING, LINCOLN, NEBRASKA, OCTOBER 24-26, 1955. 24: 1-211. 1955. 55.9 N212

The proceedings of the 24th annual meeting of the National Reclamation were given. The principal addresses and papers presented at the meeting were given along with the discussions of them and the committee reports. (Mostly on irrigation and reclamation).

3892. National Reclamation Association. PROCEEDINGS OF THE TWENTY-FIFTH ANNUAL MEETING, SALT LAKE CITY, UTAH NOVEMBER 14-16, 1956. 25: 1-202. 1956. 55.9 N212

The proceedings of the 25th annual meeting of the National Reclamation were given. The principal addresses and papers presented at the meeting were given along with the discussions of them and the committee reports. (Mostly on irrigation and reclamation).

3893. Naylor, P. E. CONTROL OF WATERLOGGING AND SALINITY IN WEST PAKISTAN. Internatl. J. Agr. Aff. 4(1): 1-12. Oct. 1963. 281.8 In82

A report was given on the need and use of drainage for irrigated land and for the control of salinity in West Pakistan. Drainage was not recommended for land where irrigation water was not available.

3894. Nefedov, V. D., and Rozin, V. A. WATER ECONOMICS IN CZECHOSLOVAKIA. (Rus) Gidrotekh. i Melior. 9(3): 39-51. Mar. 1957. 290.8 G362

3895. Nerozin, A. LEACHING OF SALINE LANDS. (Rus) Khlopkovodstvo. 5(12): 50-52. Dec. 1955. 72.8 K522

3896. Neudecker, J. DRAINAGE AND IRRIGATION IN CARINTHIA. (Ge) Oesterr. Wasserwirt. 14(10/11): 215-221. map. Oct./Nov. 1962. 55.8 Oe8

3897. Neves, J. R. B. IRRIGATION AND DRAINAGE. (Por) Minas Gerais. Dept. de Prod. Veg. B. de Agr. 6(3/4): 21-25. Mar./Apr. 1957. 9.2 M663

3898. Neveux, M. IRRIGATION AND DRAINAGE OF THE FIELDS. (Fr) Avenirs 150/151: 180-181. Mar. 1964. 275.1 Av3

3899. Nichoson, H. H. DRAINAGE, IRRIGATION AND WATER SUPPLY FOR CROPS. Yorkshire Agr. Soc. J. 1958(109): 27-34. 1958. 10 Y7

The importance of drainage and irrigation were given. British experiences with hill and mechanized drainage were discussed along with ditch maintenance.

3900. Nijhawan, S. D. HOW TO RECLAIM SALINE AND ALKALINE SOILS. Indian Farming. 6(7): 13-15. Oct. 1956. 22 In283

Methods used to reclaim saline and alkaline soils in India were given.

3901. Nikitin, A. G., and Sannikov, G. P. AGRICULTURAL IMPROVEMENTS IN GERMAN DEMOCRATIC REPUBLIC. (Rus) Gidrotekh. i Melior. 10: 55-62. Oct. 1964. 290.8 G362

3902. Novikova, A. V. THE RESULTS AND PROSPECTS OF INVESTIGATIONS INTO THE RECLAMATION OF SOLONETZ SOILS IN CRIMEA. (Rus) Pochvovedenie. 8: 31-43. Ref. Aug. 1956. 57.8 P34

3903. Novikova, A. A. IN REGARD TO A MELIORATIVE EVALUATION OF THE CRIMEAN STEPPE SOILS, POSSIBILITIES OF APPEARANCE AND PREVENTION OF A SECOND SALINIZATION DURING IRRIGATION WITH WATER FROM THE NORTH-CRIMEAN CANAL. (Rus) Pochven. Inst. im. V. V. Dokuchaeva. Trudy. 54: 255-274. Ref. 1958. 56.9 P44

3904. Novikova, A. V. IMPROVEMENT OF SOLONETZ SOILS OF MEADOW-STEPPE COMPLEXES OF THE CRIMEAN REGION. (Rus) Ukrain. Nauch.-Issled. Inst. Pochvoved. Nauch. Trudy. 5: 132-159. Ref. 1961. 56.9 Uk72

3905. Obezmuradov, B. UTILIZATION OF VIRGIN AND IDLE LAND IN THE ZONE OF THE KARAKUM CANAL. (Rus) Sel'sk. Khoz. Turkmenistana. 4: 49-53. July/Aug. 1962. 20 Se4982

3906. Obrejanu, G., Albescu, I., Maianu, A., Pasa, V., Axionova, I., and Melacrinos, A. RESEARCH ON THE COMPLEX OF MEASURES NECESSARY TO IMPROVEMENT OF A SECONDARILY SALINIZED SOIL OF THE DANUBE FLOOD ZONE, WITH A VIEW TO RICE CULTURE. (Rum) Bucharest Inst. Cent. Cercet. Agr. Sect. Pedol. An. Ser. A, 30: 237-248. Ref. 1962, pub. 1963. 21 R86A
French summary.

3907. Obrejanu, G., Maianu, A., Albescu, I., Unceanschi, L., Pasa, V., and Axionova, I. EXPERIMENTAL RESEARCH BEARING ON THE IMPROVEMENT OF SOILS AFFECTED WITH SECONDARY SALINIZATION IN RICE FIELDS OF THE DANUBE FLOOD PLAIN. (Rum) Bucharest Inst. de Cercet. Agron. An. Ser. A, Agroclimatol. Pedol. Agrochim. si Imbunatatiri Funciare. 28: 51-68. Ref. 1960, pub. 1961. 21 R86A
French summary.

3908. Oliveira-E-Sousa, E. NOTE ON THE DRAINAGE AND IRRIGATION OF SOME PEAT LANDS IN PORTUGUESE AFRICA. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 322-325. 1958, pub. 1960. 290.9 C765C
English summary.

A brief report was given on drainage and irrigation problems on peat soils in Africa.

3909. Ono, H. IMPROVEMENT OF IRRIGATION AND DRAINAGE IN WET LOWLAND (NAKA RIVER AREA) AT THE NORTHERN DISTRICT OF TOKYO. Cong. Irrig. and Drainage Trans. 3(5): 10.291-10.338. maps. 1957. 55.9 C7652

A report was given on the improvement of irrigation and drainage in a wet lowland area project in Japan.

3910. Oprea, C. V. IMPROVEMENT OF SALINE AND ALKALINE SOILS OF THE RUMANIAN PEOPLE'S REPUBLIC. (Rum) Bucharest Acad. Repub. Pop. Romine. Studii si Cercet. Biol. si Sti. Agr. 9(1/2): 177-230. Ref. 1962. 21 B855
French summary.

3911. Oroszlany, I. ECONOMIC TECHNICAL MEASURES FOR THE PRESERVATION OF OPTIMAL SOIL MOISTURE CONDITIONS WHICH HAVE BEEN OBTAINED, BY MEANS OF HYDROTECHNICAL INSTALLATIONS, IN AREAS UNDER THE THREAT OF SUBSOIL WATERS OR OF DROUGHT. (Rus) Za Sotsilist. Sel'skokhoz. Nauk. 1959(2): 212-216. 1959. 64.8 Z1

3912. Oseledets, N. N. PHENOMENON OF SALINIZATION IN THE TOBACCO NURSERIES AND ITS ELIMINATION. (Rus) Tabak. 16(2): 20-21. 1955. 69.8 T112

3913. Ostapchik, V. P. SUBSURFACE IRRIGATION. (Rus) Moskva, Moskovskii Rabochii. 27 pp. 1962. 55 Os72

3914. Ota, K. PROBLEMS OF READJUSTMENT OF ARABLE LAND AS FOUNDATION OF THE AGRICULTURAL DEVELOPMENT IN SWAMPY PADDY FIELD. (Ja) Gifu U. Facul. Agr. Res. B. 9: 213-221. Dec. 1958. 107.6 G364
Englich summary.

A report was given on the improvements of drainage and irrigation systems for the swampy paddy fields in Japan. The readjustment and the improvement of drainage and irrigation helped to bring about better land management and improved crop.

3915. Overwater, C. TEN YEARS OF THE PRINCE BERNHARD POLDER. (Du) 1950-1960. Surinaamse Landb. 8(5): 159-218. map. 1960. 9.6 Su7
English summary.

A report was given of 10 years of research on the Prince Bernhard Polder in Surinam, irrigation and drainage are practiced in the same ditches. Dikes are used to keep water out of the area.

3916. Oztan, B., and Dincer, D. RICE GROWING FOR RECLAMATION OF SALT- AND SODIUM-AFFECTED SOILS IN THE CUKUROVA PLAIN. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 291-294. 1961. 278.9 Un3

A report was given on the use of rice crops to reclaim salt- and sodium-affected land in Turkey. Changes occurred in the soluble salt content and exchangeable sodium percentage as a result of leaching, use of gypsum, and rice cultivation. The rice crop helped pay for the construction of the drainage canals and the rice stubble supplied organic matter to the soil.

3917. Panifilov, V. RECLAMATION OF SOLONETZ SOILS. (Rus) Sel'sk. Khoz. Sibiri. 1961(6): 15-16. June. 1961. 20 Se492

3918. Panin, P. I. SALT DISCHARGE AND THE DETERMINATION OF LEACHING RATES. (Rus) Pochvovedenie. 1962(7): 31-38. Ref. July 1962. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 7: 31-38. Ref. July 1962. 57.8 P34Ae

A report was given on the salt discharge from leaching of saline soils in the U.S.S.R. for the design of drainage system.

3919. Panin, P. S. CHANGES IN THE PERCOLATION OF SALINE SOILS DURING LEACHING. Pochvovedenie. 1962(7): 48-53. Ref. 1962. 57.8 P34
English translation—Soviet Soil Sci. 5: 563-567. Ref. May 1959. 57.8 P34Ae

A study of percolation and the gravitational flow of water in the leached layer of a saline soil by use of special soil monoliths was reported.

3920. Pechkurov, A. F. REGULATION OF MOISTURE IN PEAT SOILS BY INTRA-SOIL IRRIGATION. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU ZABOLOCHENNYKH POCHV, 1955. Trudy, pp. 62-103. Ref. Minsk, 1956. 54.9 K83

3921. Pena, I. De La. IRRIGATION, DRAINAGE, AND SALINITY. (Sp) Ingen. Hidraul. en Mex. 18(1/2): 34-38. Jan./June 1964. 290.8 In43

3922. Perekhrest, S. M. WATER ECONOMICS IN SPAIN. (Rus) Gidrotekh. i Melior. 8(10): 50-60. Oct. 1956. 290.8 G362

3923. Perigaud, S. PROBLEMS POSED BY DRAINAGE AND IRRIGATION OF THE SOILS OF BRENNE. (Fr) Ann. Agron. 12(1): 145-155. 1961. 14 F8499

3924. Petinov, N. S., Volkov, I. A., and Peshekhonova, N. F. DEVELOPMENT OF THE ROOT SYSTEM IN SPRING WHEAT IN SUBSURFACE IRRIGATION. (Rus) Akad. Nauk SSSR. Inst. Fiziol. Rast. im. K. A. Timirizeva. Sborn. Rabot. 1956(2): 296-304. Ref. 55 Ak1

3925. Petrosian, G. P. ON THE IMPORTANCE OF ALFALFA IN THE RECLAMATION OF SALINE SOILS. (Rus) Akad. Nauk Armfanskoi SSR. Izv. Biol. i Sel'skokhoz. Nauk. 9(12): 77-89. 1956. 20 Er4

3926. Petrov, E. G., and Ukolov, I. A. CONDITION OF SOIL IMPROVEMENT AND ITS DEVELOPMENT IN MURGAB OASIS. (Rus) Gidrotekh. i Melior. 5: 1-9. May 1964. 290.8 G362

3927. Piacco, R. DITCHES IN RICE FIELDS. (It) Prog. Agr. 2(12): 1145-1150. Dec. 1956. 58.8 P94

3928. Piacco, R. IRRIGATION IN THE PEAT RICE FIELDS. (It) Irrigazione. 6(3): 29-37. 1959. 55.8 Ir733
English summary.

The perculiar procedure used for irrigation of peaty rice fields in Italy was discussed.

3929. Pillsbury, A. F. DRAINAGE IN IRRIGATED DESSERTS. Calif. Agr. 11(4): 35-36. Apr. 1957. 100 C12Cag

A report was given on the efficient design, installation, and maintenance of drainage systems for irrigated areas in California to avoid crop damage by high salinity.

3930. Pillsbury, A. F. WATER TABLE CONTROL IN ARID AND SEMI-ARID REGIONS. Cong. Irrig. and Drain. Trans. 4(2): 11.65-11.84. Ref. 1960. 55.9 C7652

Prime objective of water table control in arid and semi-arid regions is to provide a soil environment for plant roots reasonably low in salts. A discussion was given on ways that water table control can be accomplished by subsurface drainage facilities and management of irrigation practices.

Characteristics of pump drainage, ditch drainage, and tile drainage were discussed along with drainage investigation techniques.

3931. Pochvennyi Institut Imeni V. V. Dokuchaeva. THE APPLICATION OF DRAINAGE IN THE RECLAMATION OF SALINIZED SOILS. [Translation] Jerusalem, Israel Program for Scientific Translations, 1960. 228 pp. 1960. 54 P753Ae

Eleven papers were presented on the problems of applying drainage as a measure against the salinization of irrigated soils in the U.S.S.R.

3932. Popov, A. A. ON CHANGES IN SOIL-RECLAMATION CONDITIONS BROUGHT ABOUT BY RIDGING ON THE VOLGA-AKHTUBA BOTTOMLAND. (Rus) Pochvovedenie. 1960(7): 63-73. map. Ref. 1960. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 7: 739-746. 1960. 57.8 P34Ae

A report was given on the increased salinity in an area in the U.S.S.R. after it was diked. Recommendations were made on ways to reduce this salinity conditions.

3933. Preobrazhenskaya, M. V. WATER-SALT BALANCE OF SOILS AS AFFECTED BY THE OVERHEAD IRRIGATION OF COTTON AND THE HIGH LEVEL OF UNDERGROUND WATER. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 6: 92-101. 1964. 20 V633
English summary.

A report was given on the use of high level of underground water during the winter and low level of underground water plus sprinkler irrigation in the growing season to reduce salinity in cotton fields in the U.S.S.R.

3934. Preobrazhenskii, T. AGAIN IN REGARD TO A THOROUGH RECLAMATION OF SALINE SOILS AND SWAMPY LANDS. (Rus) Khlopkovodstvo. 5(8): 51-54. Aug. 1955. 72.8 K522

3935. Press, H. THE CONTROL OF THE WATER TABLE IN DRAINED SOILS; (preventing excessive drainage). Cong. Irrig. and Drain. Trans. 5(5): R.17.284-R.17.292. 1963. 55.9 C7652

Combined irrigation and drainage systems were recommended for Germany to prevent excessive drainage and to control the water table.

3936. Prettenhoffer, E. DEPTH PROGRESS OF IMPROVEMENT OF CALCIUM-DEFICIENT ALKALINE PROFILES. (Fr) Cong. Internatl. de la Sci. du Sol. Rap. 6(D, comn VI): 621-630. 1956. 56.09 In8452
English summary.

A report was given on the improvement of nearly neutral and slightly alkaline limefree alkali soils in Hungary by the use of chemicals plus leaching.

3937. Prettenhoffer, I. METHODS OF IMPROVEMENT OF SALTY SOLONETZ SOILS. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 4: 43-47. 1962. 20 M57

3938. Prettenhoffer, I. SUBSOILING AS AN ADDITIONAL DEVELOPMENT IN THE AMELIORATION OF NON-CARBONATIC ALKALI SOLONETZ SOILS. (Ge) Agrokem. es Talajtan. 13(sup.): 227-235. May 1964. 385 Ag83
English summary.

A report was given on the use of subsoiling of non-carbonatic alkali Solonetz soils in Hungary to increase crop yields.

3939. Quackenbush, T. H. SOIL AND WATER CONSERVATION ON IRRIGATED FARMS. Assoc. West. State Engin. Proc. 30: 19-22. 1957. 290.9 As76

A report was given on soil and water conservation needs for irrigated farms in the United States. The need of drainage for irrigated land and a report on the salinity problem were included.

3940. Quackenbush, T. H. IRRIGATORS' MANAGEMENT KEY TO WATER SAVING. Soil Conserv. 28(9): 214-215. May 1963. 1.6 So3S

A report was given on the use of land leveling, lined ditches, pipelines, and effective irrigation management to save irrigation water.

3941. Quackenbush, T. H., Renfro, G. M., Beauchamp, K. H., Lawhon, L. F., and Eley, G. W. CONSERVATION IRRIGATION IN HUMID AREAS. U.S. Dept. Agr., Agr. Hdbk. 107, 52 pp. Jan. 1957. 1 Ag84Ah

The advantages of surface drainage for surface irrigation systems were discussed along with the construction and maintenance of irrigation ditches. The use of open drains, tile drains, and mole drains for both drainage and subirrigation was included.

3942. Quackenbush, T. H., and Thorne, M. D. IRRIGATION IN THE EAST. U.S. Dept. Agr., Agr. Ybk. 1957: 368-278. 1957. 1 Ag84Y

A discussion was given on the need and use of irrigation in the Eastern United States. The need and use of drainage along with irrigation were stressed.

3943. Rabochev, I. S. IMPROVEMENT OF HYDROMORPHIC SALTY SOILS. (Rus) Khlopkovodstvo 3: 43-45. Mar. 1963. 72.8 K522

3944. Rachinskii, A. A. RATIONALIZATION OF LEACHING TECHNIQUE IN AMU DARYA LOWLAND. (Rus) Khlopkovodstvo. 9: 46-48. Sept. 1964. 72.8 K522

3945. Rafaelian, A. S. SUBSOIL MOLE IRRIGATION UNDER CONDITIONS OF ARAS LOWLAND. (Rus) Akad. Nauk Armianskoi SSR. Izv. Biol. i Sel'skokhoz. Nauk. 9(12): 59-75. Ref. 1956. 20 Er4

3946. Rafaelyan, A. S. RESULTS OF OPERATIONS FOR THE CHEMICAL RECLAMATION OF SALINE SOILS IN OKTEMBERYAN DISTRICT. (Arm) Armenia. Min. Sel'sk. Khoz. Upravlenie Sel'skokhoz. Nauki. Izv. Sel'skokhoz. Nauki. 1961(9): 75-87. 1961. 20 Ar52
Russian summary.

3947. Ragazzi, G. POST-RECLAMATION DESALTING OF THE FERRARESE SALT LOAMY GROUND. Cong. Irrig. and Drain. Trans. 4(3): 11.771-11.778. map. Ref. 1960. 55.9 C7652

A report was given on the desalting of reclaimed land by both natural rainfall and irrigation of rice crops in drained areas in Italy.

3948. Ragazzi, G. REMOVAL OF SALT FROM SALINE AND CLAY SOILS OF FERRARA AFTER RECLAMATION. (It) Mercanzia. 15(12): 1329-1334. Dec. 1960. 287 B635

3949. Raju, V. S. LAND GRADING FOR IRRIGATION. Trans. ASAE 3(1): 38-41. 1960. 290.9 Am32T

A report was given on the use of land grading for surface drainage for irrigation. The fixed volume center method described gave accurate slopes for uniformly graded surface and was simple to apply.

3950. Rampilova, M. A. METHODS OF GASHEISKAIA MTS OF BURIAT-MONGOLIAN ASSR IN STRENGTHENING THE FORAGE SUPPLY BASE. (Rus) Bibliot. po Polevod. i Lugovodstvu. 1957(12): 130-137. 1957. 64.8 B472

3951. Raney, W. A. DEVELOPING EFFICIENT IRRIGATION IN RAIN BELT. Cotton Prod. Conf. Proc. 3: 16-17. 1957. 72.9 C828

A report was given on essential physical and biological considerations needed for efficient irrigation in the Eastern United States.

3952. Rao, D. V. K., Rao, V. S. R., and Raju, K. V. A NEW DEAL FOR ANDHRA'S SALINE LANDS. Indian Farming. 12(10): 14, 17. Jan. 1963. 22 In283

A report was given of the reclamation of saline lands of coastal Andhra Pradesh, India by using: Rice straw or green manures; a saline variety of rice; adequate manuring; continuous cropping with good quality irrigation water; provision for adequate drainage; and keeping the water table low.

3953. Rapp, E. LAND LEVELING FOR IRRIGATION. Res. Farmers. 8(3): 14-15. Summer 1963. 7 R31

A report was given on the use of land leveling for irrigated lands in Canada—mostly for the border—dike method of irrigation. Costs have ranged from 12 to 35 cents per yard of soil moved depending on: Soil type and conditions; the degree of finish; the amount of topsoil replaced; cost of ewuipment; and the experience of the equipment operator.

3954. Ratledge, W. R. TRIPLE PURPOSE DITCHES. Soil Conserv. 21: 230-232. May 1956. 1.6 So3S

A report on the use of the same ditches for drainage and for water for surface irrigation and for sprinkler irrigation in Selbyville, Dell, was given for 50 acres of blueberries and 50 acres of other crops. Large ditches with a capacity of nearly 2 cubic yards per foot were equipped at the outlet ends with creosoted water control structures. Flash boards can be added or removed to permit either storage or drainage of water.

3955. Rattier, C. IRRIGATION AND DRAINAGE IN THE ZONES OF DE'L HABRA AND LE SIG. (Fr) Cong. Irrig. and Drainage Trans. 3(5): 10.59-10.70. maps. 1957. 55.9 C7652

Drainage problems in an area of Algeria were described. Saline ground water is just below the surface in the area. The methods used to solve the drainage problems were described along with a description of the maintenance and reclamation of the salty land.

3956. Reed, D. E. ECONOMIC SIGNIFICANCE OF RETURN FLOW SYSTEM AS USED IN TULARE M. A. D. Calif. Mosquito Control Assoc. Proc. and Papers. 28: 82-83. 1960. 428 C673

A report was given on the economics of use of the Return Flow System of irrigation water in the Tulare Mosquito Abatement District in California.

3957. Reeve, R. C. THE RELATION OF SALINITY TO IRRIGATION AND DRAINAGE REQUIREMENTS. Cong. Irrig. and Drain. Trans. 3(5): 10.175-10.187. 1957. 55.9 C7652

A report was given on the relationship of salinity to the irrigation and drainage requirements. An ewuation was given for the depth of irrigation water required to meet the crops needs and the leaching requirement. The requirements for drainage include the control of the water table and the discharge of both excess water and salts.

3958. Reeve, R. C. DRAINAGE OF IRRIGATED LANDS. Soil Conserv. 23(1): 12-15. Aug. 1957. 1.6 So3S

A report was given on research on drainage problems in irrigated areas.

3959. Reeve, R. C. RECLAMATION OF SALT AFFECTED SOILS. Agr. Engin. 39(8): 475. 1958. 58.8 Ag83

An abstract was given of a paper on the reclamation of salt affected soils involving the removal of excess salts or exchangeable sodium and the restoration of favorable soil physical conditions.

3960. Reeve, R. C., and Bower, C. A. USE OF HIGH-SALT WATERS AS A FLOCCULANT AND SOURCE OF DIVALENT CATIONS FOR RECLAIMING SODIC SOILS. Soil Sci. 90(2): 139-144. Ref. Aug. 1960. 56.8 So3

A method was proposed for reclaiming sodic soils by using high-salt waters as a flocculant and as a source of divalent cations. In a laboratory trial, 0.4 feet of Salton sea water combined with 6.0 feet of Colorado River water completely equilibrated the experimental soil column in one-tenth of the time required for Colorado River water alone.

3961. Reeve, R. C., Pillsbury, A. F., and Wilcox, L. V. RECLAMATION OF A SALINE AND BORON SOIL IN THE COACHELIA VALLEY OF CALIFORNIA. Hilgardia. 24: 69-91. 1955. 100 C12H

Results were reported of both flushing and leaching salts from a saline-alkali soil in the Coachella Valley of California's Colorado Desert. A quantitative evaluation was given of the effectiveness of removing a salt crust by flushing, was compared and the removal of the usual salts with the removal of a high concentration of B. Flushing as a reclamation procedure was ineffective. Leaching removed 80 percent of the initially high salts with the application of 1 foot of water for each foot depth of soil considered. Equal leaching of B required three times as much water.

3962. Remorenko, V. V., and Antykov, A. Y. RECLAMATION OF SALTY SOILS IS AN URGENT TASK. (Rus) Sel'sk. Khoz. Sev. Kavkaz. 11: 31-34. Nov. 1962. 20 Se495

3963. Renaud, U. WATER ECONOMY IN THE SAHARA BY SUB-SURFACE IRRIGATION OF SAND AND GRAVEL SEED BEDS. (Fr) United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 16: 327-330. 1961. 278.9 Un3
English summary.

A report was given on the use of plastic tubes with small lateral perforations for subsurface irrigation of sand and gravel seedbeds in Africa (Sahara Desert).

3964. Renfro, G. M. APPLYING WATER UNDER THE SURFACE OF THE GROUND. U.S. Dept. Agr., Agr. Ybk. 1955: 273-278. 1955. 1 Ag84Y

A report on subirrigation was given along with a report on the necessary drainage for the system. Water may be introduced into the soil profile through open ditches, mole drains, or tile drains. The same system of ditches is used for drainage.

3965. Resch, W. F. REHABILITATION AT RIO GRANDE. Reclam. Era. 46(4): 89-91. Nov. 1960. 156.84 R24

A report was given on improvement of irrigation and drainage projects on the Rio Grande Project in New Mexico and Texas.

3966. Reuss, J. O., and Campbell, R. E. IMPROVE YOUR SALTY SOILS. Mont. State Coll. Ext. Folder 72, 8 pp. Mar. 1961. 275.29 M76FoL

An illustrated guide was given on the use of drainage and soil amendments for improving salty soils in Montana.

3967. Richards, L. A., and Hayward, H. E. SALINITY HAZARDS. Proc. Intersociety Conf. on Irrig. and Drain. 1957. I: 93-96. 1959. 55.9 In83

A report on the salinity hazards connected with irrigation hazards was given along with research data on the improvement of saline soils due to irrigation.

3968. Ridiger, V. R. SUBSURFACE MOLE IRRIGATION. (Rus) Gidrotekh. i. Melior. 10(3): 30-34. Mar. 1958. 290.8 G362

3969. Rios, A. THE PROBLEM OF SODIUM NITRATE IN THE IRRIGATION DISTRICTS IN MEXICO. (Sp) Ingen. Hidraul. en Mex. 14(3): 27-42. July/Sept. 1960. 290.8 In43
English summary.

A report was given on the drainage of alkali soils in Mexico containing sodium nitrates. Because of the high costs of tile drainage, a system of mole drainage was used.

3970. Robinson, C. W., and Schumaker, G. BIG YIELDS MADE ON "PROBLEM" SOILS. Colo. Rancher and Farmer. 18(10): 5-6. 1964. 6 C714

Results of cooperative research being conducted in the lower Grand Valley west of Grand Junction, are pointing the way to increased production of field crops on the fine-textured problem soils of the area. These irrigated soils are often plagued with problems of: Poor drainage; excessive salt and sodium accumulation; crusting; poor water intake; and erosion. A pump installed in 1951 effectively lowered the high water table to solve the poor drainage. The rotation and fertilizer work studied the relative desirability of a short-term rotation of corn, sugar beets, and barley in contrast to a long-term rotation which included these same crops and 3 years of alfalfa. The merits of continuous cropping of cultivated crops, corn and sugar beets, were also studied.

3971. Ross, P. E., and Swanson, N. P. LEVEL IRRIGATION. J. Soil and Water Conserv. 12(5): 209-214. Sept. 1957. 56.8 J822

A report was given on the principles and practice of level irrigation.

3972. Rozanoff, A. N. THE SYSTEM OF SCIENTIFIC INVESTIGATION IN PROJECTS FOR THE IRRIGATION AND RECLAMATION OF SALINE SOILS. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14: 223-226. 1961. 278.9 Un3

A report was given on the scientific investigations of projects for the irrigation and reclamation of saline soils in the U.S.S.R.

3973. Rozanov, A. N. MELIORATION OF SALINE SOILS IN HUNGARY. (Rus) Pochvovedenie. 10: 87-92. Oct. 1955. 57.8 P34

3974. Rozhdestvenskii, M. AUTUMNAL-WINTER LEACHING [OF SALINE COTTON SOILS]—A MOST IMPORTANT AGROTECHNICAL MEASURE. (Rus) Khlopkovodstvo. 7(12): 24-28. Dec. 1957. 72.8 K522

3975. Rubey, H. IRRIGATION-DRAINAGE-CLIMATOLOGY FOR FLAT HUMID LAND. J. Irrig. and Drain. Div., ASCE 83(IR 1) 10 pp. may 1957. 290.9 Am3Ps

Irrigation, drainage, and climatology were combined to increase profits on large holdings on flat humid lands. A pioneering development in the Mississippi River Delta was described.

3976. Ruiz-Castrejon, E., and Trueba-Gomez, A. INTERRELATION BETWEEN IRRIGATION AND DRAINAGE; A STUDY OF THE PARTICULAR CASE OF THE ESTUARY OF THE RIVER GUADALQUIVIR. Cong. Irrig. and Drain. Trans. 3(5): 10.43-10.58. maps. 1957. 55.9 C7652

A report was given on the interrelation between irrigation and drainage on some flat salty lowlands in Spain.

3977. Russell, J. S., and Brooker, M. I. H. PRELIMINARY EXPERIMENTS ON THE RECLAMATION OF A SALINE-SODIC SOIL IN THE JERVOIS AREA. So. Austral. Dept. Agr. Expt. Rec. 1: 5-20. May 1963. 23 So89

A report was given on some preliminary experiments on the reclamation of a saline sodic soil in South Australia with leaching plus gypsum.

3978. Sabol'ch, I. ALKALI SOILS [SOLONETZ] IN HUNGARY. (Rus) Pochvovedenie. 1956(11): 9-18. Nov. 1956. 57.8 P34

3979. Sainz Ibarra, F. THE IMPORTANCE OF DRAINAGE IN THE PROBLEM OF SALTPETER IN THE SOILS IN NORTHWESTERN MEXICO. (Sp) Mex. Agr. 5(58): 26. Dec. 1958. 8 M5762

3980. Sakane, E. S. DRAINAGE PROJECT IN AN AREA WITH HIGH WATER TABLE IN THE EASTERN DISTRICT OF OSAKA. Cong. Irrig. and Drain. Trans. 3(5): 10.267-10.290. 1957. 55.9 C7652

General features of land with high waters were given and the interrelated problems of irrigation and drainage were discussed. The Neya River System in Japan was given as a typical example of the problems involved.

3981. Salamin, P. INTERRELATION BETWEEN IRRIGATION AND DRAINAGE. (Fr) Cong. Irrig. and Drain. Trans. 3(5): 10.117-10.146. map. Ref. 1957. 55.9 C7652
English summary.

A report was given on the interrelation between irrigation and drainage in Hungary and the need to remove excess surface and irrigation water from the land. Procedures for determining the quanity of excess surface water were discussed.

3982. Sambur, G. N., Katerinich, T. D., and Yunik, S. M. MOBILITY OF EXCHANGEABLE SODIUM AND THE ESTABLISHMENT OF RATES IN MELIORATION OF SOLONETZ SOILS. (Rus) Pochvovedenie. 11: 35-46. Ref. Nov. 1963. 57.8 P34
English summary.
English translation—Soviet Soil Sci. 11: 1040-1049. Ref. Nov. 1963. 57.8 P34Ae

A report was given on the use of gypsum to help improve solonetz soils in the U.S.S.R.

3983. Sandu, G. THE ALKALIZATION OF SOILS GROWN TO RICE IN THE DANUBA PLAIN AND MEASURES NEEDED TO PREVENT ITS INTENSIFICATION. (Rum) Prob. Agr.[Bucharest] 14(12): 60-70. Ref. Dec. 1962. 21 R862
French summary.

3984. Saveson, I. L. SOIL MOISTURE CONTROL IN THE MISSISSIPPI VALLEY. Cotton Trade J. Internatl. Ybk. (28): 55-56. 1960-61. 72.8 C82141

A report was given on the need and use of soil moisture control by tillage, drainage, and irrigation in the Mississippi Valley.

3985. Schulz-Falkenhain, H. VERSATILE USE OF IRRIGATION WORKS. (Ge) Deut. Landwirt.-Gesell. Mitt. 70: 1217. Dec. 1, 1955. 18 N39

3986. Scott, P. A. SOME ASPECTS OF IRRIGATION AND RECLAMATION IN BRITISH GUIANA. Cong. Irrig. and Drain. Trans. 4(2): 11.85-11.96. maps. 1960. 55.9 C7652

A discussion was given of drainage and irrigation requirements for rice in British Guiana. A description was given of a 25,000 acres reclamation scheme, the Black Bush Polder.

3987. Seggern, M. E. Von. COSTS AND ECONOMIC ASPECTS OF DRAINAGE OF IRRIGATED LAND. Internatl. Seminar Soil and Water Util. Proc. 1962: 211-214. 1962. 56.9 In86

An economic analysis was given on drainage requirements for irrigated land.

3988. Sequera Tamayo, P. E. RECOVERY OF SALINE SOILS. (Sp) Yaritagua. Estac. Expt. de Cana de Azucar de Occidente. B. 58, 30 pp. Ref. Mar. 1955. 65.9 Y2

3989. Shevelev, Y. Z. UTILIZATION OF DRAINAGE NETWORK FOR IRRIGATION. (Rus) Sel'sk. Khoz. Sev.-Zapadnoi Zony. 1962(6): 84-87. June 1962. 20 Se497

3990. Shiue, J. J. A STUDY ON THE RECLAMATION OF SALTED ALLUVIAL SOILS IN TAIWAN. (Ch) Taiwan Sugar Expt. Sta., Rpt. 24: 73-117. Ref. May 1961. 65.9 F76R
English summary.

A report was given on the value of a 3-year rotation system of paddy rice and paddy sugarcane to improve saline soils in Taiwan.

3991. Simonneau, P. TEMPORARY PHENOMENA OF SALINIZATION IN ALGERIAN AND SAHARIAN IRRIGATED SOILS. (Fr) Ann. Agron. 12(6): 561-571. 1961. 14 F8499
English summary.

A report was given on the temporary phenomena of salinization in irrigated soils in Algeria and Sahara. These temporary phenomena of salinization can be checked by lining the surfaces of the canals, drainage, leveling, and the cultivation of hydrophilous vegetation.

3992. Skosyreva, K. N. ON THE LEACHING OF SALINE TAKYR SOILS IN THE ZONE OF THE KARAKUM CANAL. (Rus) Akad. Nauk Turkemnskoi SSR. Izv. Ser. Biol. Nauk 1961(6): 48-60. 1961. 442.9 Ak124

3993. Smith, J..B. IRRIGATION, DRAINAGE AND RECLAMATION. (Ara) Iraq. Min. Agr. Majallatu-'Zzira'-ati'l-'Iraqiyah. 11(2/3): 197-202. Apr./Sept. 1956. 22.5 IR1
English summary, pp. 4-5.

With proper irrigation and drainage, salinity was not formed and there was no need for reclamation in Iraq.

3994. Smith, S. T. HANDLING SALT LAND. West. Austral. Dept. Agr. J. (ser. 3)5(6): 729-731. Nov./Dec. 1956. 23 W52J

The conversion of bare saline areas to useful grazing land by land management practices was given. The management practices stressed were: (1) The control of grazing; (2) soil cultivation to improve leaching; and (3) the introduction of salt tolerant species.

3995. Soil and Water Conservation Research Division. SOIL AND WATER CONSERVATION RESEARCH IN THE PACIFIC COAST REGION. U.S. Dept. Agr., Agr. Res. Serv. Misc. P. 900, 26 pp. 1962. 1 Ag84M

Soil and water research in the Pacific coast area is especially concerned with soil moisture and water entry in soils. Much of the rainfall and the water applied for irrigation evaporates from the soils. In places, water moves upward from ground water tables and evaporates at the soil surface; soils then become salinized. In other places sodic soils need to be reclaimed by leaching with high-salt water.

Existing irrigation and drainage systems need to be redesigned or operated more efficiently. Ground water studies are essential: To understand the processes of recharging reservoirs and wells; to facilitate recharging in order to have sufficient water during dry periods; and to locate areas for recharging when there is excess water.

3996. Soil and Water Conservation Research Division. LIST OF PUBLICATIONS OF U.S. SALINITY LABORATORY. U.S.Dept. Agr., Agr. Res. Serv., Soil and Water Conserv. Res. Div., U.S. Salinity Lab., Unnumbered Rpt., 26 pp. 1962. 1.965 A2L693

3997. Spurling, M. B. RECLAIMING SEEPAGE-AFFECTED LAND. So. Austral. Dept. Agr. J. 61(1): 12-14. Aug. 1957. 23 So84

Seepage affected land in South Australia have been reclaimed by the following steps: (1) Removing the high water table by providing adequate drainage; (2) removing excess salts from the topsoil by irrigation or flood watering; and (3) rebuilding the soil by using gypsum or sulfur and increasing the organic matter by cover cropping.

3998. Sriramamurthy, G. LEACHING TRIALS WITH A SALINE-ALKALI SOIL. I. A STUDY OF THE PROCESS OF LEACHING OUT OF SALTS IN THREE SUCCESSIVE LEACHINGS. Andhra Agr. J. 7(6): 199-211. 1960. 34.2 An4

Results were presented of some leaching trials with saline-alkali soils in India.

3999. Srivastava, P. B. L., Mehrotra, C. L., and Agarwal, R. R. THE EFFECT OF LEACHING SALINE ALKALI SOILS WITH IRRIGATION WATERS OF DIFFERENT KINDS ON THE PERMEABILITY AND THE COMPOSITION OF THE SOILS AND THE COMPOSITION OF THE LEACHATES. Indian Soc. Soil Sci. J. 10(2): 93-98. June 1962. 56.9 In2

A report was given on the effect of leaching saline alkali soils in India with different kinds of irrigation water to study their effect on the composition of the soil and the composition of the leachates.

4000. Stoneman, T. C. GYPSUM FOR SALT LAND? West. Austral. Dept. Agr. J. (ser. 3)7(2): 155-156. Mar./Apr. 1958. 23 W52J

Gypsum was not recommended for salt lands in Western Australia as the soils are not high sodium soils and salt free irrigation water is not available to flush out the land.

4001. Stoneman, T. C. SALT LAND—PROGRAMME FOR AUTUMN. West. Austral. Dept. Agr. J. (ser. 3)7(3): 359-360. May/June 1958. 23 W52J

Fall reclamation of "salt land" in Australia pasture land was stressed.

4002. Supino, G., Montanari, V., and Fassetta, L. INTERRELATION BETWEEN IRRIGATION AND DRAINAGE. Cong. Irrig. and Drain. Trans. 3(5): 10.339-10.350. maps. 1957. 55.9 C7652

The conditions necessary to secure proper drainage without damage to crops were given. Typical examples were discussed of land reclamation in northern Italy where drainage canals are used for irrigation purposes.

4003. Sutton, J. H. WATER MANAGEMENT OF ORGANIC SOILS. Cong. Irrig. and Drain. Trans. 5(5): R.17.161-R.17.186. map. Ref. 1963. 55.9 C7652

A report was given on water management of organic soils by drainage and irrigation to prevent subsidence.

4004. Swan, B. LAND PREPARATION FOR BORDER IRRIGATION. West. Austral. Dept. Agr. J. (ser. 4)4(1): 31-34, 37-40. Jan. 1963. 23 W52J

A report was given on the use of leveling for surface drainage and border irrigation in Australia.

4005. Sweet, C. L. DRAINAGE AND GROUND-WATER PROBLEMS. West. Farm Equip. 55(8): 27-29. Aug. 1958. 58.8 Im73

The importance of proper drainage and salinity control for irrigated lands in California were discussed.

4006. Szabolcs, I. IMPROVEMENT METHODS FOR ALKALI SOILS. (Hu) Mezogazdasagi Vilagirodalom 4(3): 1-9. Ref. 1962. 19 M577

4007. Szabolcs, I. AMELIORATION OF ALKALINE AND SALINE SOILS. United Nations Conf. Appl. Sci. and Technol. Benefit Less Developed Areas. [Working Papers, Agr.], v. 4, No. 160, 5 pp. Oct. 4, 1962. (E/CONF. 39/C/160) 281.9 Un392

A report was given on the amelioration of alkaline and saline soils in Hungary by leaching of salts and/or chemical reclamation materials.

4008. Szabolcs, I. IMPROVEMENT OF SALTY SOILS WITH SMALL DOSES OF SOIL IMPROVING SUBSTANCES. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 1: 46-48. 1964. 20 M57

4009. Szabolcs, I., and Abraham, L. IMPROVING OF ALKALI SOILS WITH SMALL DOSES OF RECLAMATION MATERIALS. Agrokem. es Talajtan. 13(sup.): 247-253. May 1964. 385 Ag83

A report was given on the reclamation of alkali soils by the use of small doses of lime and gypsum in Hungary. In some cases, the effects of small doses were larger than that received from large doses of the same materials.

4010. Sziki, G. SOME PROBLEMS IN UTILIZATION OF EXHAUSTED ALKALI SOILS OF RICE. (Hu) Debrecen. Mezogazdasagi Akad. Tudo. Evkon. 1961: 65-70. 1962. 105.9 D35 German summary.

4011. Szuniewicz, J. WATER RELATIONS IN THE PEAT BOG KUWASY. (Pol) Warsaw Inst. Melior. i Uzytkow Zielonych. Wiad. 3(3): 79-100. 1963. 54.9 W262W

4012. Tabor, C. C. DRAINAGE AND SALT BALANCE IN RELATION TO IMPERIAL IRRIGATION DISTRICT. Conf. on Quality of Water for Irrig. Proc. Water Resources Cent., U. Calif. Contrib. 14: 76-84. Jan. 1958. 55.9 C7693

Over the years, the Imperial Irrigation District has constructed an extensive drainage system to provide acres of land. The drains provide only an arterial system into which the individual landowner can dump his drainage. As a rule, this is accomplished by installation of an underground system of tile drain lines.

4013. T'ang, S. Y. PROBLEMS IN IMPROVEMENT AND THE SPECIAL NATURE OF THE SALINE SOILS ON THE COAST OF NORTHERN KIANGSU. (Ch) Acta Pedol. Sinica. 12(4): 421-431. Ref. Dec. 1964. 56.9 Ac8
Russian summary.

4014. Teimurov, K. G. POSSIBILITIES FOR IMPROVEMENT OF SOLONCHAK SOILS BY RICE CULTURE. (Rus) Khlopkovodstvo. 7: 26-27. July 1962. 72.8 K522

4015. Teimurov, K. G. IS IT POSSIBLE TO SPEED UP A GENERAL LEACHING OF SOILS? (Rus) Khlopkovodstvo. 11: 35-37. Nov. 1963. 72.8 K522

4016. Temnyi, M. T., and Stefanenko, V. V. DRAINAGE IRRIGATION OF GRAPES. (Rus) Sadovodstvo. 1960(6): 49-50. June 1960. 80 Sa13

4017. Terra, G. J. A. RECLAMATION OBJECTIVES ON SALINE TROPICAL SOILS, IN RELATION TO CLIMATE AND SOIL. (Du) Landbk. Tijdschr. 70(extra no.): 519-527. July 1958. 105.2 Or3

4018. Thorne, D. W., and Peterson, H. B. IRRIGATED SOILS; THEIR FERTILITY AND MANAGEMENT. Ed. 2. McGraw-Hill Book., Inc., N.Y. 392 pp. 1954. 56.7 T393

A textbook was given on irrigation and management of irrigated soils. Several chapters were devoted to the following factors that concern drainage: (1) Soil and water relations; (2) soil water and plant relations; (3) the salt problem; (4) quality and source of irrigation water; (5) drainage; (6) reclamation and management of saline and alkaline soils; and (7) control of the physical properties of soil.

4019. Toro, H. IRRIGATION AND DRAINAGE SYSTEM OF THE LAJAS VALLEY. (Sp) Rev. de Agr. de P. R. 51(1): 219-221. map. Jan./June 1964. 8 R325

4020. Torrecabrera, J. A NEW TECHNIQUE OF SUBSURFACE IRRIGATION. (Sp) Cult. Mod. 44(8): 293-294. Aug. 1961. 15 C89

4021. Tsukanova, A. I. IMPROVEMENT OF SOLONETZ AND ALKALINE SOILS OF THE LOWER VOLGA REGION. (Rus) Zemledelie. 1: 55-56. Jan. 1964. 20 Z44

4022. Tsukanova, A. I. IMPROVEMENT OF THE SOLONETZ SOILS. (Rus) Zemledelie. 9: 40-43. Sept. 1964. 20 Z44

4023. Tsutsui, H. PROBLEMS IN THE IMPROVEMENT OF DELTAIC WATER-LOGGED PADDY FIELD WITH SPECIAL REFERENCE TO IRRIGATION AND UNDERGROUND DRAINAGE. UN. Econ. Comm. Asia Far East Water Resources Ser. 25: 194-195. 1963. 290.9 Un35F

A report was given on the problems of underground drainage and irrigation in deltaic water-logged paddy fields in Japan.

4024. Tsutsui, H. WATER MANAGEMENT IN WATERLOGGED PADDY FIELDS WITH REFERENCE TO DRAINAGE IMPROVEMENT. Internatl. Comn. Irrig. and Drain. Annu. B. 1963: 62-66. 1963. 55.9 In8A

The drainage requirements were given for water management in waterlogged paddy fields in Japan.

4025. Umarov, E. IMPROVEMENT OF SOIL CONDITIONS AND POSSIBILITIES FOR COTTON CULTURE IN THE KHOREZM OASIS. (Rus) Akad. Nauk Azerb. SSR. Izv. Ser. Geol.-Geog. Nauk i Nefti. 3: 105-115. 1963. 403 Ak12

4026. United Nations, Educational, Scientific and Cultural Organization. SALINITY PROBLEMS IN THE ARID ZONES: PROCEEDINGS OF THE TEHERAN SYMPOSIUM. United Nations Educ. Sci. and Cult. Organ. Arid Zone Res. 14. 395 pp. maps. 1961. 278.9 Un3
Text in English and French.

The papers were given that were presented at the symposium at Teheran, Iran, on salinity problems in arid zones in 1958.

4027. U.S. International Cooperation Administration Operations Mission to the Somali Republic. INTER-RIVER ECONOMIC EXPLORATION; THE SOMALI REPUBLIC. Washington. 347 pp. maps. 1961. 173.2 In8Int

A report was given on an evaluation of the potential capacity of the Inter-River Area of the Somali Republic in Africa. Included in the rrport were articles on soil classification of the area for irrigation and drainage projects.

4028. U.S. Soil Conservation Service. WATER CONSERVATION IN IRRIGATION AGRICULTURE. U.S. Dept. Agr., Soil Con. Serv. SCS-TP-141, 14 pp. 1961. 1.96 Ad6Tp

In nearly any community where a major part of the water supply is used for irrigation, future expansion in water needs might be met, at least in part, through more efficient handling and use of irrigation water.

Conservation methods of applying water on farms, coupled with efficient storage and transmission from the source, can reduce wastage and free large quantities of water for extending the irrigated acreage for at least the next 20 years, if the savings could be made available at the right places.

4029. Uppal, H. L. RECLAIMING ALKALI WASTE LANDS. Indian Council Agr. Res. B. 85, 40 pp. maps. May 1961. 22 Im7M

A report was given on research for reclaiming alkali waste lands in India.

4030. Ussery, L. R. SALINITY CONTROL THROUGH TILE DRAINS IN HIDALGO CLAY LOAM. J. Rio Grande Valley Hort. Soc. 14: 200-204. 1960. 81 L95

A tile drainage system in Hidalgo clay loam in the Lower Rio Grande Valley of Texas removed 29.5 tons of dissolved salts per acre from the top 6 feet of the soil profile during the first year of operation of the drainage system. The 6-inch concrete drain tile was placed at 6.5 to 7.5 feet below the field surface and spaced 200 feet apart, in the 30-acre field under study. Soil salinity was reduced in the top 3 feet of the soil profile to a level permitting the growth of crops of low salt tolerance. A fluctuating, highly saline water table, previously high enough to restrict crop root development, was lowered to permit leaching of salts from the soil profile by irrigation and high-intensity rainfall.

4031. Vadyunina, A. F. CHANGES IN THE PHYSICAL PROPERTIES OF YERGENI SOLONETZES UNDER THE INFLUENCE OF SHRUBS. (Rus) Pochvovedenie. 4: 31-39. Apr. 1960. 57.8 P34
English translation—Soviet Soil Sci. (4): 372-378. Apr. 1960. 57.8 P34Ae

In 1950, an experiment was inaugurated in Russia on the melioration of solonetzes by the application of gypsum and by the biological method of planting shrubs.

Information describing the changes that occurred under the influence of the shrubs in certain properties of the solonetzes that had not been treated with gypsum was given. The meliorating action of Tamarix, sumac (Cotinus), Elaegnus, the yellow acacia, Tatar maple, and box-elder was studied. The shrubs were planted in 1952. The growth and development of the shrubs and the soil processes were reported for the 1953-58 period.

4032. Van Arsdall, H. E. CONTOUR PLANTING—WATER USE SERVE FLORIDA CITRUS GROWERS. Soil Conserv. 29(2): 32-34. 1963. 1.6 So3S

A report was given on the use of cover cropping, contour planting, irrigation, and drainage for citrus orchards in Florida.

4033. Van Auken, E. IRRIGATION FROM BELOW. Farm Q. 13(4): 52-55, 116. Winter 1959. 6 F22995

A report was given of the use of a tile system to both drain the soil and irrigate on muck soil in Indiana. This system greatly reduced the subsidence of the muck soil. The costs were $300-$400 per acre.

4034. van Schaik, J. C., and Milne, R. A. SALT ACCUMULATION IN A GLACIAL TILL SOIL IN THE PRESENCE OF SALINE GROUNDWATER AT SHALLOW DEPTHS. Canad. J. Soil Sci. 43: 135-140. 1963. 56.8 C162

Considerable salt accumulation occurred in a grass-covered soil in southern Alberta where the saline ground water was maintained at a depth of 3 feet. The SAR values of the saturation extract increased significantly under grass, and indications were that this increase was mainly due to precipitation of calcium. A fallow soil did not show a significant salt accumulation above the water table.

It was suggested that a leaching program was necessary to maintain low salinity where shallow water tables were present and shallow tile drains were used.

4035. Vapaev, M., and Inileev, A. MELIORATION IN THE SOUTHERN PART OF KHOREZM AREA. (Rus) Khlopkovodstvo. 8: 38-41. map. Aug. 1964. 72.8 K522

4036. Varuntsian, E. S. RECLAMATION OF SALINE, DRAINED LANDS OF THE KURA-ARAS LOWLAND FOR AGRICULTURE. (Rus) Agrobiologiia. 2: 98-104. Mar./Apr. 1956. 20Ag822

4037. Varuntsyan, E. S. SYSTEM OF DEEP DRAINAGE FOR RECLAMATION OF SALINE SOILS. (Rus) Gidrotekh. i Melior. 9: 3-11. Sept. 1962. 290.8 G362

4038. Varuntsyan, E. S. SOME EXPERIENCE ON RAPID IRREVERSIBLE DESALTING OF SALINE SOILS AND GROUND WATER. Internatl. Comn. Irrig. and Drain. Annu. B. 1962: 13-17, 26. 1962. 55.9 In8A

A report was given on the Jafarkhan drainage system and others in the U.S.S.R. for irrigation drainage and drainage for salinity control.

4039. Varuntsyan, E. S. FORCED LEACHING OF SALTY SOILS. (Rus) Khlopkovodstvo. 4: 37-41. Apr. 1963. 72.8 K522

4040. Vasil'chenko, A. V. SOAKING AND LEACHING IRRIGATION. (Rus) Zemledelie. 8: 37-41. Aug. 1964. 20 Z44

4041. Vasil'eva, I. A. REGULATION OF UNDERGROUND WATER LEVEL BY SLUICING. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 74: 259-266. 1962. 20 M857

4042. Vasudev, S. R. INTERRELATION BETWEEN IRRIGATION AND DRAINAGE. Cong. Irrig. and Drain. Trans. 3(5): 10.102-10.115. Ref. 1957. 55.9 C7652

A report was given on the interrelationship between irrigation and drainage in India. The various methods used for preventing waterlogging and of reclaiming waterlogged lands were described. The studies needed to design a drainage system were described.

4043. Velev, D. ECONOMIC EFFECT OF IRRIGATION AND PUMP DRAINAGE. (Fr) World Power Conf. Canad. Sect. Mtg. Paper H(10), 8 pp. 1958. 290.9 W89
English summary.

A report was given on the economic effects of drainage and irrigation in Bulgaria.

4044. Velichko, E. THE LEVELLING OF RICE FIELDS. Indian Agr. 6(1/2): 223-225. Jan./July 1962. 22 In294.

A report was given on the leveling of rice fields in India during the fallow season and then sowing to grass. The field is only leveled once in thr rotation that includes rice.

4045. Veliev, M. I. EFFECTIVENESS OF LEACHING OF SALTY SOILS WITH THE HELP OF DEEP DRAINAGE. (Rus) Khlopkovodstvo. 7: 35-37. July 1962. 72.8 K522

4046. Veliev, M. I. ACCELERATED IMPROVEMENT OF SALTY SOILS IN AREA OF OPEN DRAINAGE NETWORK. (Rus) Gidrotekh. i Melior. 9: 7-10. Sept. 1963. 290.8 G362

4047. Verhoeven, I. B. SOIL SALINITY—A WORLD-WIDE PROBLEM. Span. 4(4): 162-165. 1961. 464.8 Sp2

A report was given on soil salinity throughout the world and the costs and use of reclamation practice on them.

4048. Videira-E-Castro, A. IRRIGATION PROBLEMS ON SALINE SOILS. (Por) Gaz. do Agr. 13(147): 236-237. Aug. 1961. 24 G25

4049. Visser, W. C., and Bloemen, G. W. THE WATER BALANCE AS A BASIS FOR IRRIGATION RESEARCH. Inst. for Land and Water Mangt. Res., Wageningen. Tech. B. 8: 1-5. 1959. 282.9 W12T

A report was given on the use of water balance as the basics for drainage and irrigation research in the Netherlands.

4050. Vladimirov, A. G. THE LEACHING EFFECT OF IRRIGATION AS A MEASURE FOR CONTROLLING NATURAL SOIL SALINITY. (Rus) Gidrotekh. i Melior. 10(10): 8-16. Oct. 1958. 290.8 G362

4051. Vladimirov, A. G. EFFECTIVENESS OF HORIZONTAL DRAINAGE AND THE DISTRICTING, WITH REFERENCE TO RECLAMATION AND HYDROGEOLOGY, OF THE GOLODNAYA STEP. (Rus) Gidrotekh. i Melior. 1960(3): 44-55. maps. Mar. 1960. 290.8 G362

4052. Vlugter, H. SOME ASPECTS OF WATER-CONTROL IN WEST PAKISTAN. Pakistan J. Sci. 12(4): 181-183. July 1960. 475 P172

A report was given on waterlogged and saline soils in West Pakistan and the need of drainage now and in the future for the drainage of irrigated lands and drainage for salinity control.

4053. Volkovskii, P. A. IRRIGATION OF FLOOD PLAINS BY SUPPLYING WATER UNDER PRESSURE THROUGH COVERED DRAINAGE SYSTEM. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 82: 21-33. 1962. 20 M857

4054. Volynov, A. M. COMPLEX UTILIZATION OF VERTICAL DRAINAGE FOR RECLAMATION. (Rus) Khlopkovodstvo. 8: 51-57. map. Aug. 1962. 72.8 K522

4055. Walker, C. W. DRAINAGE PROBLEMS IN THE YAKIMA VALLEY. Irrig. Engin. and Maintenance. 9(10): 12-13. Sept. 1959. 55.8 Ir722

A report was given of the drainage problem in an irrigated area in Washington.

4056. Wang, S. C. TEN TIPS ON RECLAIMING SALTED ALLUVIAL SOILS IN TAIWAN. Taiwan. Taiwan Sugar. 5(4): 20-22. Apr. 1958. 65.8 T133

The methods used for reclaiming salted alluvial soils in Taiwan are: (1) Exploitation of more sources of ground water for leaching; (2) lower the ground water level; (3) dig salt-removing drainage ditches; (4) plow deep; (5) plant Sesbain sesban; (6) apply organic manure; (7) plant paddy sugarcane; (8) shade the soil; (9) plant salt-tolerant varieties of sugarcane; and (10) scratch the surface soil of small alkali areas.

4057. Wang, T. C. THE ROLE OF DRAINAGE ON THE PREVENTION OF SOIL SALINIZATION. (Ch) Acta Pedol. Sinica. 12(3): 369-372. Ref. Sept. 1964. 56.9 Ac8

4058. Wang, T. C., Liu, Y. C., Li, L. C., and Tung, C. P. THE SALINIZATION PREVENTION PLAN AND ITS APPLICATION ON THE SOIL OF LIAO-CH'ENG IN SHANTUNG. (Ch) Acta Pedol. Sinica. 12(1): 10-22. map. Ref. Mar. 1964. 56.9 Ac8

4059. Water Conservancy Research Institute of Shansi. SHANSIS ALKALINE AOIL AND PROBLEMS CONCERNING ITS IMPROVEMENT. Chung-Kuo Nune-Pao. 2: 13-16. Feb. 1962. Translations from Chung-Kuo Nung Pao JPRS: 16, 607. pp. 17-25. 1962. 173 J663TFc

An English translation was given of the distribution of alkali soil in Shansi, China and recommendation for its improvement.

4060. Wavrin, W. D. IRRIGATED LAND LEVELING SAVES WATER AND LABOR. Soil Conserv. 28(9): 208-209. May 1963. 1.6 So3S

A report was given on a land leveling project in North Dakota that saves both irrigation water and labor.

4061. Webster, A. DRAINAGE IN THE RIVERINE PLAINS OF NORTHERN VICTORIA, AUSTRALIA, WITH SPECIAL REFERENCE TO GROUND WATER HYDROLOGY. Cong. Irrig. and Drain. Trans. 3(5): 10.27-10.42. map. Ref. 1957. 55.9 C7652

A report was given on the occurrence of waterlogging and salting that followed irrigation in Northern Victoria, Australia. Surface and subsurface drainage problems for the area were discussed. Surface drainage is now used in the area but the need for surface and subsurface drainage related to crop and soil condition needs additional research.

4062. Weeks, L. O. DRAINAGE IN THE COACHELLA VALLEY OF CALIFORNIA. J. Irrig. and Drain. Div., ASCE 85(IR 3, 2158): 83-88. Sept. 1959. 290.9 Am3Ps

A report was given on the need, construction, and use of tile drainage in the irrigated Coachella Valley of California, mainly for salinity control.

4063. Wen, N. J., and Wang, A. C. A PRELIMINARY DISCUSSION ON THE IMPROVED USE AND ANALYSIS OF THE SALINE SOILS IN THE SOUTHERN PART OF HUPEI PROVINCE SINCE THE NORTHERN WEI. (Ch) Acta Pedol. Sinica. 12(3): 346-357. Ref. Sept. 1964. 56.9 Ac8
Russian summary.

4064. West, B., and Kadri, L. IRRIGATION AND DRAINAGE. (Sum.) Iraq. Min. Agr. Majallatu-'Zzira'atil-'Iraqiyah. 13(1): 6. Jan./Mar. 1958. 22.5 Irl

A report was given on the effect of sediment in the irrigation water in Iraq.

4065. Westerhof, J. J. LAND DEVELOPMENT PROJECT IN TUNISIA. Way Ahead. 9(4): 9-14. maps. 1962. 280.8 W362

A report was given on a land development project in Tunisia, Africa. The irrigation, drainage, and the control of salinity in the area were discussed.

4066. White, A. H. BIG PROBLEM IN TEXAS HIGH PLAINS—IRRIGATION "TAIL WATER." Grain Prod. News 14, i.e. 13(2, i.e. 8): 11, 18-19. June 1961. 286.81 G764

A report was given on the reuse of irrigation tailwater in Texas by diverting the water into ponds and then using it for additional water for irrigation.

4067. Worrall, G. A. WORK ON IMPROVEMENT OF SALINE-ALKALI LAND ON THE UNIVERSITY FARM, KHARTOUM, 1956-59. J. Agr. Sci. [London] 57(3): 367-371. Nov. 1961. 10 J822

A report was given on the reclamation of saline-alkali land in Nigeria. Deep subsoiling was most successful as it brought over 50 percent removal of the soils. Irrigation without any cultivation removed 29 percent.

4068. Woudt, B. D. V. OBSERVATIONS ON THE EFFICIENCY OF SUB-IRRIGATION IN HEAVY SOILS. Canad. J. Agr. Sci. 37: 588-592. 1956. 56.8 C162

The interest in subirrigation has lately been revived because of its successful application in a number of sandy soils, peats, and some heavy soils in the Netherlands. In heavy soils, the difficulty is encountered that water extraction by roots tends to exceed moisture replenishment from a water table. This is related to the slow capillary movement in heavy soils and to the fact that the rate of this movement declines progressively as the soil-moisture content is further depleted by the roots. The rate can be maintained where the soil is kept moist by occasional rain storms during the period of subirrigation. Measurement of pasture production at various depths of water table and under varying climatic conditions showed that subirrigation can be quite successful if supplemented by rain; in the absence of rain subirrigation was quite inefficient. Some observations have been referred to which show that substantial amounts of water can be derived from a water table, even in heavy soils, where active roots penetrate close to it, but an undue rise in the level of the water table should be averted in that case.

4069. Wilcox, L. V. SALINITY—A HIDDEN DANGER. Cotton Trade J. Internatl. Ybk. 1958/59: 58, 64. 1958. 72.8 C82141

The danger and control of salinity and alkalinity for cotton fields were discussed. Adequate drainage was listed as the most important single factor in the reclamation of a salty soil or in the management of a nonsaline soil under irrigation.

4070. Wilcox, L. V. SALINITY CAUSED BY IRRIGATION. Amer. Water Works Assoc. J. 54(2): 217-222. Feb. 1962. 292.9 Am32J

A report was given on the effects of irrigation on salinity in the soil. The importance was stressed of keeping a balance between the salt brought in the irrigation water and that removed by the drainage water so that salinity will not be a factor.

4071. Willardson, L. S. IRRIGATION FOR MARSHLANDS. Internatl. Comn. Irrig. and Drain. 4(2): 11.139-11.144. 1960. 55.9 C7652

The existence of swampy or waterlogged areas indicates a close balance between the water supply and the water needs of the area. Extreme excesses of water cause lakes to be formed instead of marshes. Some irrigation water supply scheme must be included in the reclamation plan to replace that removed from the area by drainage. Irrigation water may be provided by pumping ground water, subirrigation, pumping from drains, or storage upstream of the water causing the problem. Some methods of providing water for the area may also eliminate the drainage problem.

4072. Willardson, L. S. WHAT IS IRRIGATION EFFICIENCY? Irrig. Engin. and Maintenance. 10(4): 13-14, 18. 1960. 290.9 Am3Ps

The objective of efficient irrigation is to provide a desirable moisture environment in the soil with the greatest uniformity and the least water loss. Unless these three terms are evaluated together, the true efficiency of irrigation will be unknown.

The following efficiency terms were defined: (1) Project water use; (2) farm water use; (3) field water use; (4) water conveyance; (5) farm water application; (6) field water application; (7) water storage; (8) moisture storage capacity; and (9) water distribution.

4073. Wilson, L. NEED FOR DRAINAGE. Farm and Home Sci. [Utah Sta.] 21(3): 72-73. Sept. 1960. 100 Ut1F

An illustrated report was given for the need for drainage of irrigated and saline soils in Utah.

4074. Wilson, L. G., Luthin, J. N., and Biggar, J. W. DRAINAGE-SALINITY INVESTIGATION OF THE TULELAKE LEASE LANDS. Calif. Agr. Expt. Sta. B. 779, 56 pp. maps. Ref. Apr. 1961. 100 C12S

The objectives, procedures, and conclusions reached in a 4-year drainage-salinity investigations of Tulelake lease lands in California were summarized.

4075. Wilson, R. G., and Frederick, W. J. IRRIGATED LAND NEEDS DRAINAGE TOO: COLORADO FARMERS SOLVED LOCAL PROBLEM WITH GROUP PROJECT. Land and Water Contract. 3(11): 9. 1961. 56.8 L222

A report was given on a group project in Colorado to provide adequate drainage outlet for an irrigated area.

4076. Wrenn, E. ALKALI LAND RECLAMATION: BOOSTING PROFITS 2,000%. West. Crops. and Farm Mangt. 9(10): 21-23. Oct. 1960. 281.8 F2225

A report was given on the economics of reclaiming alkali land in Nevada by leveling, the use of open drains, and the use of a good crop rotation.

4077. Yadav, J. S. P., and Agarwal, R. R. A COMPARATIVE STUDY ON THE EFFECTIVENESS OF GYPSUM AND DHAINCHA (SESBANIA ACULEATA) IN THE RECLAMATION OF A SALINE-ALKALI SOIL. Indian Soc. Soil Sci. J. 9(3): 151-156. Ref. Sept. 1961. 56.9 In2

Field trials showed the effectiveness of gypsum for the reclamation of saline-alkali land and then the use of dhainchia (Sebania aculeata) as a green manure crop restored the physical condition of the soil and enriched the soil in nitrogen and organic matter for India.

4078. Yegorov, V. V. THE TASK OF SOIL SCIENCE IN THE DEVELOPMENT OF IRRIGATED AGRICULTURE. (Rus) Pochvovendenie. 4: 1-8. Apr. 1964. 57.8 P34
English translation—Soviet Soil Sci. 4: 341-346. Apr. 1964. 57.8 P34Ae

A report was given on the task of soil science for the development of irrigated agriculture in the U.S.S.R. The need for surface drainage and subsurface drainage for salinity control was stressed.

4079. Ying, T. THE RECLAMATION AND UTILIZATION OF SALINE SOILS. Sci. World. 6(2): 11-13. 1962. 472 Sci25

A report was given on the reclamation and utilization of saline soils (inland saline soils and coastal saline soils) in China by drainage, leaching, deep plowing, and the application of manure. Crop rotation are practiced on areas where drainage is difficult.

4080. Youll, W. J. ESTABLISHMENT OF COLEAMBALLY IRRIGATION AREA ON THE MURRUMBIDGESS RIVER IN NEW SOUTH WALES. Internatl. Comn. Irrig. and Drain. Annu. B. 1960. pp. 30-45. 1960. 55.9 In8A

The past, present, and future development of irrigation in the Murrumbridgee Valley in New South Wales, Australia were given. Recommendations were listed for the drainage of the systems.

4081. Yu, H. M. A STUDY ON THE SOIL SALINIZATION ACTIVITIES IN THE WIDELY IRRIGATED TA-YU AREA OF SHANTUNG. (Ch) Turang Tongbao. 2: 17-20. 1964. 56.8 T792

4082. Yuldashev, A. REGULATION OF THE WATER-SALT REGIME OF SOILS OF THE KARAGANDA MASSIF. (Rus) Sel'sk. Khoz. Tadzhikistana. 1962(1): 23-25. Jan. 1962. 20 Se494

4083. Zakhidov, A., Benyaminovich, E., and Ozersky, E. TECHNICAL AND ECONOMIC ASPECTS OF IRRIGATION AND DRAINAGE OF THE GOLODNY STEPPE. (Rus) United Nations. Conf. Appl. Sci. and Technol. Benefit Less Developed Areas. [Working Papers, Agr.], v. 7, No. 339, 8 pp. map. Oct. 23, 1962. (E/Conf. 39/C/339) 281.9 Un392
English summary, 2 pp.

4084. Zasukhin, S. V., and Mel'nikov, V. M. SOME URGENT PROBLEMS IN WATER DEVELOPMENT OF OUR COUNTRY. (Rus) Gidrotekh. i Melior. 1959(11): 3-8. Nov. 1959. 290.8 G362

4085. Zavodnov, S. S., and Morozov, V. K. CONTROL OF REGULAR SOIL MOISTENING IN SUBSURFACE IRRIGATION. (Rus) Gidrotekh. i Melior. 1962 (1): 27-33. Jan. 1962. 290.8 G362

4086. Zhilinskii, V. A. DETERMINATION OF FILTRATION LOSSES OF WATER FROM CANALS [FOR IRRIGATION]. (Rus) Timiriazevskaia Sel'skokhoz. Akad. Izv. 1957(1): 128-139. 1957. 106 P44

SEE ALSO—147, 369, 381, 382, 384, 385, 393, 454, 483, 504, 510, 555, 559, 574, 590, 653, 667, 668, 692, 698, 724, 748, 750, 797, 799, 805, 812, 816, 821, 836, 860, 864, 873, 886, 902, 904, 923, 931, 972, 978, 996, 1002, 1028, 1049, 1051, 1105, 1131, 1134, 1142, 1146, 1157, 1159, 1176, 1213, 1230, 1254, 1288, 1301, 1364, 1381, 1387, 1396, 1398, 1424, 1431, 1444, 1500, 1502, 1517, 1522, 1597, 1607, 1613, 1620, 1625, 1626, 1631, 1633, 1643, 1644, 1646, 1647, 1652, 1653, 1657, 1660, 1665, 1677, 1704, 1713, 1729, 1738, 1752, 1756, 1757, 1763, 1766, 1767, 1769, 1770, 1781, 1796, 1797, 1802, 1804, 1816, 1822, 1825, 1860, 1865, 1866-1868, 1879, 1880, 1895, 1912, 1914, 1917, 1921, 1926, 1940, 1949, 1966, 1984, 1987, 1994, 1997, 2001, 2039, 2051, 2057-2059, 2064, 2066, 2074, 2077, 2099, 2107, 2109-2111, 2120, 2124, 2138, 2144-2146, 2151, 2153, 2157, 2159, 2161, 2166, 2167, 2176, 2194, 2200, 2218, 2226, 2232, 2238, 2284, 2291, 2292, 2295, 2325, 2330, 2332, 2338, 2345, 2346, 2351, 2353, 2355, 2378-2380, 2383, 2384, 2398, 2406, 2411, 2412, 2414, 2427, 2437, 2438, 2441, 2445-2457, 2459-2464, 2466, 2468-2470, 2477, 2487, 2492, 2508, 2517, 2519, 2529, 2538, 2556, 2557, 2559, 2562, 2567, 2574, 2581, 2586, 2588, 2594, 2596, 2597, 2599, 2609, 2623, 2628, 2633, 2641, 2645, 2649, 2654, 2664, 2665, 2668, 2669, 2674, 2677, 2680, 2688, 2689, 2698, 2699, 2705, 2706, 2710, 2712, 2715, 2717, 2723, 2725, 2737, 2744, 2764-2767, 2778, 2789, 2791, 2794, 2805, 2809, 2810, 2823, 2825, 2828, 2835, 2844, 2847, 2865, 2869, 2894-2897, 2910, 2918, 2919, 2932, 2935, 2948, 2953, 2957, 2966, 2969, 2977, 2995, 3005, 3009, 3017, 3024, 3025, 3050, 3069, 3070, 3078, 3079, 3083, 3098, 3117, 3121, 3133, 3140, 3143-3145, 3147, 3156, 3173, 3177, 3181, 3182, 3186, 3198, 3204, 3205, 3211-3213, 3223, 3241-3243, 3257, 3259, 3288, 3297, 3324, 3330, 3331, 3369, 3405, 3412, 3424, 3494, 3502, 3503, 3508, 3514. 3516, 3519, 3531, 3536, 3538, 3548, 3560, 3564, 3567, 3577, 3578, 4125, 4198, 4219, 4238, 4246, 4260, 4356, 4372, 4407, 4408, 4413, 4426, 4461, 4540, 4557, 4758, 4841, 4857, 4906, 4998, 5046, 5058, 5065, 5070.

Equipment and Materials

4087. Aamodt, H. TRENCH CUTTING MACHINES WITH GREAT CAPACITY. (No) Norsk Landbr. 1957(15): 307-308. July 19, 1957. 11 N8122

4088. Aamodt, H. UNIVERSAL EXCAVATORS ARE THE MOST VERSATILE IN THIS COUNTRY. (No) Norsk Landbr. 1957(16): 326-328, 335. Aug. 2, 1957. 11 N8122

4089. Aamodt. H. EQUIPMENT FOR MECHANICAL DITCHING. (No) Vollebekk. Landbrtek. Inst. Orientering 12, 102 pp. 1960. 58.9 V88

4090. Akhmedzhanov, M., and Pishchikov, B. PLOW TRACTORS IN THE SERVICE OF CLEANING IRRIGATION CANALS. (Rus) Khlopkovodstvo. 8:55. Aug. 1964. 72.8 K522

4091. Aliev, Y. MACHINERY FOR MOLE DRAINING. (Rus) Tekh. v Sel'sk. Khoz. 7: 40-42. July 1963. 58.8 M11

4092. Almlof, E., and Hjalmarsson, B. THE USE OF TRENCHING PLOWS. (Sw) Jordbrtek. Inst. Meddel. 271, 37 pp. 1957. 58.9 J762
English summary.

Trenching plows with elevator chains were described and illustrated that are used in Sweden to install tile drains in the stonefree clay areas of Sweden. The plows generally used make trenches with a width of 7 inches and a depth of up to 4 feet. The average output varies from 350 feet per hour for favorable soils and long trenchs down to 100 feet per hour for short trenches, stony, very wet, or very dry soils.

4093. Amemiya, M., and Namken, L. N. AN ECONOMICAL "GO-CART" FOR A NEUTRON PROBE AND SCALER. Soil Sci. Soc. Amer. Proc. 24(6): 528. 1960. 56.9 So3

An economical carrier was illustrated and described for the use with a neutron probe and scaler.

4094. Anderson, J. R. VINYL FILM LINER FOR EARTH-FILL RESERVOIRS. Civil Engin. 30(6): 42-43. 1960. 280.9 C49

A black 8-mil vinyl film liner was installed in three reservoirs in South Davis County Water Improvement Districts, Utah, in 1959. The reservoirs have capacities of 1, 5, and 9 acre-ft. and serve as equalizing storage for three separate pressure units. They provide irrigation water for 1,000 acres of land in the rolling foothills of the Wasatch Mountains.

The installation of the plastic in the three reservoirs was described.

The result was a very neat appearing reservoir, completed in a minimum of time, and at a relatively low cost. The cost of the liner in place was $0.475 per sq. yd.

4095. Andreevskii, N. S. SECTIONAL IRON CONCRETE MATERIALS IN IRRIGATION AND DRAINAGE SYSTEMS IN THE UKRAINIAN SSR. (Rus) Gidrotekh. i Melior. 9(3): 7-21. Mar. 1957. 290.8 G362

4096. Anonymous. DRAINAGE; A NEW FIELD FOR PLASTICS. Farm Q. 18(1): 82-84, 86, 89-90, 94. Feb./Apr. 1963. 6 F22995

A discussion was given on the use of plastics for drainage as filter materials, plastic mole drains, and plastic drain pipes.

4097. Armco Drainage and Metal Products, Inc. HANDBOOK OF DRAINAGE AND CONSTRUCTION PRODUCTS. Armco Drainage and Metal Products, Inc. Middletin, Ohio, 579 pp. 1955. 290 Ar51

A revised edition of a handbook was given on drainage and construction products.

4098. Armstrong, J. J., Burke, W., and Quinn, E. A NEW DRAINAGE PLOUGH FOR PEATLAND. Scot. Forestry. 16(1): 31-33. Jan. 1962. 99.8 Sco3

A new subsurface peat drainage plow used in Scotland was described and illustrated.

4099. Autio, K. MECHANICAL DIGGING OF DITCHES FOR FORESTRY PURPOSES IN WINTER CONDITIONS. (Fi) Metsataloudellinen Aikakauslehti. 5: 163-164. 1955. 99.9 F49
English summary, pp. 156.

A report was given on the mechanical drainage of ditches in forests in Finland. In most cases, with the new machines tested, better quality ditches could be made during the winter. Snow did not hamper the work until it was nearly one meter deep.

4100. Barrett, J. W. A CART FOR A NEUTRON PROBE AND SCALER. J. Forestry. 62(7): 501-502. July 1964. 99.8 F768

A two-wheeled cart was described and illustrated for the use for a neutron probe and scaler for soil moisture measurements in the field.

4101. Bates, J. G. THE DEVELOPMENT OF LAND DRAINAGE MACHINERY AND EQUIPMENT. Inst. Brit. Agr. Engin. J. 12(2): 29-45. 1955/56. 58.9 In7

A report was given on the development of land drainage machinery and equipment for the British Isles. The following types of machines were discussed and illustrated: (1) Ditching machines, including those suitable for both digging and maintaining ditches; (2) trenching machines; and (3) mole drainers; and (4) ancillary plant, including earth moving equipment.

4102. Beasley, R. P. BUILD TERRACES EASIER TO FARM. World Farming. 6(5): 42-43, 46. May 1964. 30.08 W89

A report was given on the construction and costs of parallel terracing in Missour.

4103. Beken, A. Van Der. NEW DRAINAGE EQUIPMENT. (Fl) Land- en Tuinbouw Jaarb. 19: 215-224. 1964/65. 13 L22

4104. Bentley, W. DITCHING MACHINES AND SPECIALIZED MECHANICAL PLANT FOR CHANNEL CONSTRUCTION AND MAINTENANCE. Internatl. Comn. Irrig. and Drain. Annu. B. 1959: 76-81. 1959. 55.9 In8A

A report was given on the machinery used for irrigation and drainage canal construction and maintenance in Australia.

4105. Berdyanskii, V. N., Kuperman, E. S., and Mirsagatov, A. N. CONSTRUCTION OF BURIED DRAINAGE ON THE GOLODNAYA STEPPE. (Rus) Gidrotekh. i Melior. 1962(3): 16-22. Mar. 1962. 290.8 G362

4106. Berg, E. FERTILIZING OF FOREST MARSHLAND AND DEVELOPMENT OF DRAINAGE PLOWS IN SWEDEN. (No) Skogeieren. 42: 291-293. Aug. 15, 1955. 99.81 Sk5

4107. Berglund, G. FILTER ARRANGEMENT FOR SURFACE DRAINAGE WATER. (Sw) Grundforbattring. 12(2): 123-126. 1959. 54.8 G92

4108. Blaisdell, F. W., and Donnelly, C. A. HOOD INLET FOR CLOSED CONDUIT SPILLWAYS. Agr. Engin. 37: 670-672. Oct. 1956. 58.8 Ag83

A hood inlet for closed conduit spillways was described and illustrated. The hood inlet should be usefull in connection for: Farm pond spillways; grade stabilization or gully control dam; irrigation drops; upstream floodwater detention structures; surface drainage drop structures; and highway culverts.

4109. Blake, D. N. DESIGN OF METAL PIPE FOR IRRIGATION STRUCTURES. J. Irrig. and Drain. Div., ASCE 89(IR 3): 45-51. Sept. 1963. 290.9 Am3Ps

Two new developments in fabricating corrugated metal pipe (CMP), plus a study of changes in the corrugation configuration, result in a better finished product than that which has been produced by the riveting method. The lockseam method, which produces continuous corrugated pipe from coil stock in a variety of depths and pitches in the corrugation, reduces the leakage factor to a greater extent than does the lapseam riveting method. The spotweld method, as now used, has shown greater seam strengths. The study of new coatings to replace or improve present bituminous coatings, and the ability to develop greater strengths in lighter gage material by the changing of corrugation configuration, will expand the use of CMP in the irrigation field, as well as in other fields.

4110. Blake, D. N. DESIGN OF METAL PIPE FOR IRRIGATION STRUCTURES. Amer. Soc. Civil Engin. Trans. 129: 732-733. 1964. 290.9 Am3

A digest was given of an article written on the design of metal pipe for irrigation and drainage structures. The original article was published in the J. Irrig. and Drain. Div., ASCE 89(IR 3): 41-51, Sept. 1963.

4111. Blidaru, E. METAL AND POLYVINYL CHLORIDE TUBES USED IN IRRIGATION INSTALLATIONS. (Rum) Bucharest Acad. Repub. Pop. Romine. Filiala Iasi. Studii si Cercet. Sti. Biol. si Sti. Agr. 13(2): 371-387. 1962. 442.9 B855
French summary.

4112. Bloom, W. M. IRRIGATION PERFORMANCE OF FIBRE PIPE. Irrig. Engin. and Maintenance. 15(4): 14-15. 1965. 55.8 Ir722

A report was given of the test of fiber pipe in Texas over a 7 year period to limit water evaporation and seepage to transport a limited supply of water for irrigation.

4113. Boa, W. DEVELOPMENT OF N.I.A.E. DITCH CLEANER. J. Agr. Engin. Res. 3(1): 17-26. 1958. 58.8 J82

An illustrated report was given on the development of the N.I.A.E. ditch cleaner for digging new ditches and reclaiming old ditches in England.

4114. Boa, W. DEVELOPMENT OF A MACHINE FOR LAYING PLASTIC DRAINS. J. Agr. Engin. Res. 8(3): 221-230. Ref. 1963. 58.8 J82

A report was given on the development of a machine in England in which a flat ribbon of plastic foil is fed through a hollow subsoil blade and forms into a pipe at drain level. Water enters the pipe through the seam and through slits punched around the bottom of the pipe. Field trials were described where the machine was used satisfactorily.

4115. Bogdanov, V., and Samarov, V. NEW RECLAMATION MACHINES. (Rus) Tekh. V Sel'sk. Khoz. 1961(5): 43-45. May 1961. 58.8 M11

4116. Bogomolov, S. P., and Postnikov, B. A. NEW MACHINE TO CONCRETE IRRIGATION CANALS. (Rus) Gidrotekh. i Melior. 3: 39-44. Mar. 1963. 290.8 G362

4117. Bolotova, N. P. WAYS OF INCREASING THE TECHNICAL LEVEL AND LOWERING THE COST OF CONSTRUCTION OF IRRIGATION, DRAINAGE, AND WATER SUPPLY SYSTEMS. (Rus) Gidrotekh. i Melior. 10(4): 17-39. Apr. 1958. 290.8 G362

4118. Borshchov, T. S. MECHANIZATION OF WORK IN DRAINAGE AND RECLAMATION. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury, 231 pp. Ref. 1957. 54 B642

4119. Boving, P. A. MACHINERY FOR SOIL DRAINAGE. Calif. Agr. 12(6): 3, 15. June 1958. 100 C12Cag

Comparative analyses were made of production volumes of various kinds of earthmoving machinery used for preparing land for drainage in California.

4120. Boving, P. A. DRAINAGE COST SURVEY. Calif. Agr. 11(4): 33. Apr. 1957. 100 C12Cag

A report was given on cost of draining farm land in northern California by different types of drainage machinery.

4121. Braker, E. A. IMPACT OF MODERN EQUIPMENT ON IRRIGATION AND DRAINAGE. Civil Engin. 28(7): 506-509. July 1958. 290.8 C49

Modern equipment for irrigation and drainage was described and illustrated.

4122. Brasch, E. GOVERNMENT AID TO DRAINAGE WITH PLASTIC PIPES. (Sw) Jonkopings Lans Hushsallsk. Tidskr. 2: 3. 1964. 11 J732

4123. Broslaw, J. WHICH KIND OF PIPE? III. DEVELOPMENTS IN PLASTIC PIPE. Golf Course Rptr. 32(6): 36-38, 40. June 1964. 60.18 G83

A report was given of the developments of the following three types of plastic pipes that can be used for turf irrigation: ABS (Acrylonitrile-Butadine-Strene); PE (Polyethylene); and PVC (Polyvinyl Chloride).

4124. Brouer, B. DRAINAGE WITH EQUIPMENT. (Ge) Mitt. der Deut. Landwirt.-Gesell. 79(11): 342, 344. Mar. 12, 1964. 18 N39

4125. Bryan, B. B., and Baker, G. SMALL DIAMETER PLASTIC PIPE FOR USE IN SUBIRRIGATION. Ark. Farm Res. 8(6): 7. 1964. 100 Ar42F

During the past two years, subirrigation has been studied by agricultural engineers in Arkansas on a pilot basis at the Delta Substation.

4126. Burema, J. J. GRAPPLING AND DRAINAGE EQUIPMENT. (Du) Landbouwmechanisatie. 8(11): 526-528. Nov. 1957. 58.8 L2352

4127. Burton, W. M. MACHINERY USED IN PARALLEL TERRACE CONSTRUCTION. (Abs.) Assoc. South. Agr. Workers. Proc. 54: 49-50. 1957. 4 C82

A report was given on the following earthmoving machinery required to build an effective parallel terrace system: (1) Bulldozer; (2) bottomless scraper (dragscraper or leveler); (3) tractor and scraper (pan); and (4) land plane.

4128. Busch, C. D. LOW COST SUBSURFACE DRAINAGE. Agr. Engin. 39(2): 92-93, 97, 103. Feb. 1958. 58.8 Ag83

An experimental machine that positions slitted plastic strips to form an arch lining for mole type drains was described and illustrated.

4129. Busch, C. D. MECHANICAL MOUSE AIDS RESEARCH IN SUBSURFACE DRAINAGE. Agr. Engin. 39(5): 292-293. May 1958. 58.8 Ag83

In studies of plain and plastic-lined mole drains at Cornell University, an instrument was devised to give more information on the condition of the drain and its changes in shape.

The "measuring mouse" which is pulled through the drain on a small wire, has strain gages mounted on the rear set of spring fingers. These gages measure the changes in resistance that occur when the fingers are compressed and can be read singly to give radial distance or as a group to measure the cross sectional area. The "mouse" is designed to measure drains between 1- and 3-inches in diameter.

4130. Busch, D. D., and Edminster, T. W. MODERNIZING DRAINAGE METHODS; PLASTIC UNDERDRAINS INSTALLED IN ONE PASS ACROSS THE FIELD MAY SOMEDAY SUPPLEMENT OR REPLACE TILE INSTALLATIONS. Soil Conserv. 24(6): 131-133. Jan. 1959. 1.6 So3S

A report was given of the equipment developed to lay plastic lined mole drains.

4131. Buzacott, J. H. DITCH DIGGING. Queensland. Bur. Sugar Expt. Sta. Cane Growers' Q. B. 22(2): 45-46. Oct. 1, 1958. 65.9 Q3C

A report was given on the machinery used in Australia to dig trenches for underground drainage and irrigation pipes.

4132. Buzdin, A., and Filippov, F. NEW DIGGING MACHINES. (Rus) Tekh. v Sel'sk. Khoz. 4: 31-36. Apr. 1963. 58.8 M11

4133. Canada. Dept. of Agriculture. MACHINES FOR MARSHLAND DITCHING. Canada. Dept. Agr. P. 1195, 14 pp. 1963. 7 C16Pu

An illustrated report was given on nine machines that are used for marshland ditches in Canada.

4134. Carlson, R. H. HIGH-EXPLOSIVE DITCHING FROM LINEAR CHARGES. J. Geophysical Res. 68(12): 3693-3707. Ref. June 15, 1963. 470 J 823

Weights of linear high-explosive charges fired on the Yucca Lake playa of the Nevada test site varied from 0.23 to 42.7 lb./ft. Scaling relationships were as expected; i.e., linear-charge weight relationship to ditch volume were obtained. Ditch volume was optimum at a scaled burst depth of 2.2 where scaled burst depth is the actual depth to the center of charge divided by the square root of the charge weight per unit length. Larger ditches were created by an explosive having a circular cross section, but the same weight per unit length as a charge with a square cross section.

4135. Carlsson, H. TRENCH DIGGING MACHINE OF THE PULVERIZER TYPE. (Sw) Maskintek. i Jord och Skog 7: 300-301, 334. 1955. 58.8 M373

4136. Carmody, R. SHAPING LAND FOR WATER MANAGEMENT. Farm Q. 18(3): 64-65, 113-114, 116. Aug./Oct. 1963. 6 F22995

A report was given on the construction and use of land shaping to prepare fields for both surface drainage and irrigation.

4137. Carter, W. H. NEW MACHINE FOR DIGGING QUARTER DRAINS. La. Agr. 5(1): 5, 15. Fall 1961. 100 L 939

A report was given on a tractor-attached quarter drain machine to cut and clean drains in one operation in Louisiana.

4138. Chapman, J. R. ACCURATE TILE-LAYING BY MACHINE. Farm Mech. 12(127): 96-97. Mar. 1960. 58.8 B772

An accurate tile laying machine used in New Zealand was described and illustrated.

4139. Cooke, F. PROBLEMS OF PEAT; ACHIEVEMENT OF THE IRISH PEATLAND RESEARCH STATION. World Crops 13(10: 381-384. Oct. 1961. 281.8 W892

A report was given on peatland research at the Irish Peatland Research Station. The equipment and method used to drain peat areas were described and illustrated.

4140. Cooper, D. J., and Chancey, H. W. R. LAND CROWNING MACHINE. Res. Farmers 6(3):3. Summer 1961. 7 R31

A report was given on the value of a land crowning machine used for proper drainage of peat soil in Canada. With this machine, adequate drainage is possible with wider spacing of open ditches.

4141. Criquillion, Y. A WATER RESERVOIR WITH A CASING OF POLYETHYLENE FILM. (Fr) Pepinieristes Hort. Maraichers 47: 2055. May 1964. 80 P39

4142. Croise, R. SEWER AND DRAINAGE PIPES OF POROUS CONCRETE. (Fr) Rev. Forest Franc. 16(5): 440-441. May 1964. 99.8 R329

4143. Cross, M. W. MOLE DRAIN PLOUGH PERFORMANCES COMPARED. New Zeal. J. Agr. 105(1): 31-33, 35, 37. July 16, 1962. 23 N48J

A comparison was made of the performance of four different types of mole drain plows in New Zealand.

4144. Culpin, C. MECHANICAL EQUIPMENT FOR FIELD DRAINAGE AND DITCHING. United Nations Econ. & Social Council, Econ. Comn., Europe. Comt. Agr. Prob. AGRI/MECH 18, 47 pp. 1961. 58.9 Un3222

A report was given on the economics and use of the various types of machinery used for field drainage and ditching.

4145. Darlot. MECHANICAL MEANS OF ESTABLISHING A DRAINAGE NETWORK. (Fr) Terre Marocaine 30: 160-161. May 1956. 24 T44

4146. Davis, M. S., and Dalrymple. R. S. ALUMINUM GOES UNDERGROUND. Sprinkler Irrig. Assoc. Open Tech. Conf. Proc. 1964: 71-78. 1964. 55.9 Sp8

A report was given on the design requirements for aluminum irrigation pipe when it is to be placed underground. The SCS standards for burried aluminum pipe was printed verbatim.

4147. Decker, R. S. SEALING SMALL RESERVOIRS WITH CHEMICAL SOIL DISPERSANTS. U. S. Agr. Res. Serv. ARS-41-90: 112-131. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. Ref. Dept. Agr., Jan. 1965. A56.9 R31

A report and the discussion were given on the use of chemical soil dispersants for sealing small reservoirs.

4148. Degan, A. DISTRIBUTION OF IRRIGATION WATER BY PIPES OR CANALS? (It) Irrigazione 7(2): 10-14. July 1960. 55.8 Ir733
English summary.

A discussion was given on the choice of pipes or canals for the distribution of irrigation water in Italy. The choice depends on: Irrigation method; crops to be grown; and climatic conditions.

4149. Delperee, R. THE USE OF PLASTIC LINED MOLE DRAINS. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 128-136. 1958, pub. 1960. 290.9 C765C

A report was given on the use of plastic lined mole drains. The machinery used for laying the mole drains was described and illustrated. Costs were given for this type of drainage.

4150. Dirmeyer, R. D. SPECIFICATIONS FOR COLORADO CLAYS FOR SEALING CANALS AND PONDS. Colo. Agr. Expt. Sta., Colo. Prog. Rpt. 92, 2 pp. July 1963. 100 C71C

A progress report was given on the specifications for clays in Colorado to help seal canals and ponds.

4151. Dolan, C. H. WHICH KIND OF PIPE? 1. ASBESTOS-CEMENT. Golf Course Rptr. 32(6): 28, 30-32. June 1964. 60.18 G83

A report was given on the installation and use of asbestos-cement pipe for irrigation systems for turf.

4152. Ede, A. N. CONTINUOUSLY FORMED CONCRETE TUBE FOR DRAINAGE. Agr. Engin. 38(12): 864-866. Dec. 1957. 58.8 Ag83

A vibration-type machine designed to lay long, unbroken tubes of permeable concrete used for reinforcing mole drains was described and illustrated. The machine has been used to lay down full-scale field drainage systems. The drains cannot be laid below the water table.

4153. Ede, A. N. CONCRETE AS A MATERIAL FOR THE MECHANIZED INSTALLATION OF LAND DRAINS. Cambridge U. Abs. Diss. 1956/57: 2-3. 1959. 241.8 C14

An abstract of a thesis study of the use of concrete for land drains was given. Some of the problems of using the concrete drain tile were given along with some mechanical problems of forming permeable tubing in situ by a mobile trench technique.

4154. Edminster, T. W. DEVELOPMENTS IN EQUIPMENT AND MATERIALS FOR SUBSURFACE DRAINAGE. Internatl. Cong. Agr. Engin. 6(II): 142-149. 1964. 290.9 C7656

A report was given on the new developments in equipment and materials for subsurface drainage.

4155. Edminster, T. W., and Staff, C. E. PLASTICS IN SOIL AND WATER CONSERVATION. Agr. Engin. 42(4): 182-185. Apr. 1961; and 42(5): 248-250. May 1961. 58.8 Ag83

A discussion was given on the use of plastics in soil and water conservation in this two-part article. Requirements of the application and properties and capabilities of the plastic products were discussed for the following: Plastic pipe; irrigation tubing; mole channel liners; rice levees; irrigation borders; irrigation dams and siphons; canal and ditch linings; pond liners; plastic film for concentrating runoff; and plastic films as a mulch to reduce evaporation.

4156. Efendiev, N. T. CHARACTERISTICS OF CONSTRUCTIVE ELEMENTS OF DRAINAGE PIPES. (Rus) Moskov, Ordena Lenina Sel'skokhoz. Akad. im K. A. Timiryazeva. Dok. 82: 14-20. 1962. 20 M857

4157. El-Madani, M. SAND SCREENS AT CANAL INTAKES. Internatl. Comn. Irrig. & Drain. Annu. B. 1957: 49-51. 1957. 55.9 In8A

The pertinent conditions for a successful sand screen at a canal intake, as used in Egypt, were described and illustrated.

4158. Fafara, A. WORK ORGANIZATION AND ECONOMIC EVALUATION OF A SET OF MACHINERY FOR DIGGING AND FILLING DRAINAGE DITCHES. (Pol) Wiad. Melior. i Lakarskie 5(5): 141-146. Sept./Oct. 1962. 54.8 W63

4159. Feher, G. UNDERGROUND REINFORCED CONCRETE PIPE IRRIGATION SYSTEM. (Hu) Magyar Mezogazdasag 18(33): 14-15. Aug. 14, 1963. 19 M27

4160. Feichtinger, F. MECHANICAL DRAINAGE AND PLASTIC PIPES. (Ge) Oesterr. Wasserwirt. 16 (3/4): 84-86. Mar./Apr. 1964. 55.8 Oe8

4161. Filippov, I. G. FLEXIBLE PLASTIC PIPES IN FOREIGN AGRICULTURE. (Rus) Gidrotekh. i Melior. 9(7): 58-60. July 1957. 290.8 G362

4162. Flor, C. DIGGING FOREST DITCHES. (Da) Dansk Skovfor. Tidsskr. 41: 240-249. May 1956. 99.8 D23

4163. Fortsch, C. MECHANIZATION OF MELIORATION WORK IN THE GERMAN DEMOCRATIC REPUBLIC. (Ge) Deut. Agrartech. 9(4): 178-179. Apr. 1959. 58.8 D482

4164. Fouss, J. L. A NEW MACHINE TO LAY PLASTIC DRAINS. Civ. Engin. 33(4): 58-59. Apr. 1963. 290.8 C49

A new machine that lays plastic lining in a mole-drain channel at speeds up to 125 ft. per min. at depths of 24 to 30 in. in heavy clay soil, looks promising for many civil engineering applications. This machine was devised mainly to lay drains for agricultural purposes and has been tested in farm areas of the central United States.

4165. Fouss, J. L. PLASTIC TUBES FOR SUBSURFACE DRAINAGE. Annu. Natl. Agr. Plastics Conf. Proc. 4: 137-142. 1963. 309.9 N216

Experimental field installations have been made in several areas of the U.S. to evaluate various types of plastic mole liners under different soil and climatic conditions. The zipper-type liner appears the most promising. The structural stability of the zippered plastic mole liner depends to a large extent upon the moisture condition of the soil at the time of installation and the inherent stability of the soil surrounding the liner. The soil must have sufficient moisture to prevent excessive fracturing of the soil profile during the installation. If the soil is too dry, it cannot be "firmed" properly above the drain by the slit closure.

4166. Fouss, J. L. NEW MACHINE LAYS PLASTIC DRAINS. Amer. Soc. Civil Engin. Trans. 129: 170-171. 1964. 290.9 Am3

A digest was given of an article describing the use of a machine to lay plastic drains. The original article was published in Civil Engin. 33(4): 58-59. Apr. 1963.

4167. Fouss, J. L., Holmes, R. G., and Schwab, G. O. AUTOMATIC GRADE CONTROL FOR SUBSURFACE DRAINAGE EQUIPMENT. Trans. ASAE 7(2): 111-113. 1964. 290.9 Am32T

An automatic grade control system was reported for use on a conventional wheel type, tile trenching machine and on a floating beam mole plow for installing plastic mole drain liners.

4168. Francis, C. J., and Archer, S. G. EARTHMOVING IS BIG PART OF SOIL AND WATER CONSERVATION. Soil Conserv. 29(11): 243-245. 1964. 1.6 So3S

A report was given on the need and use of earthmoving equipment for soil and water conservation for watershed construction under Public Law 566. Statistics were given on some of the major construction practices for soil and water conservation practices in 1963.

4169. Fritzsche, O. RIGID PVC [POLYVINYL CHLORIDE] TUBE FOR UNDERGROUND IRRIGATION PIPELINES. (Ge) Deut. Agrartech. 14(7): 322-323. July 1964. 58.8 D482

4170. Fussell, G. E. THE EVOLUTION OF FARM IMPLEMENTS. IV. FIELD DRAINAGE. Chartered Land Agents' Soc. J. 58(10): 361-372. Oct. 1959. 282.9 L22

A report was given of the history of farm implements used for field drainage.

4171. Gallwitz, K. ON DRAINAGE TECHNIQUE IN THE USE OF AUTOMATIC DEPTH REGULATION EQUIPMENT FOR PLASTIC LINED MOLE DRAIN. (Ge) Internatl. Cong. Agr. Engin. 6(II): 159-168. 1964. 290.9 C765C

A report was given on the equipment for laying plastic lined mole drains.

4172. Gallwitz, K. DRAINAGE TECHNIQUE WITH APPLICATION OF AUTOMATIC DEPTH REGULATING INSTALLATIONS AND OF PLASTIC DRAIN TILES. (Ge) Landtechnik, 19. Jg., Heft 21/22, Mid-Nov. 1964. 58.8 L235

4173. Garton, J. E. ECONOMIC DESIGN OF CONCRETE PIPELINE FOR IRRIGATION PUMPING PLANTS. Agr. Engin. 43(2): 82-83. Feb. 1962. 58.8 Ag83

Economic considerations in design were reported for unreinforced underground concrete pipelines used for irrigation pumping plants.

4174. Gastila, L. I., ed. PROBLEMS OF MECHANIZATION OF RECLAMATION WORKS; COLLECTION OF PAPERS. (Rus) Vilnius, Gos. Izd-vo polit. i nauch. lit-ry. 130 pp. 1956. 58 G212

4175. Gertenbach, J. J. CONSTRUCTING CONTOURS ON SLOPES WITH DISC OR SHARE PLOUGHS. Farming So. Africa 39(7): 49, 51, 53. Oct. 1963. 24 So842

A discussion was given on the construction of contour bands (terraces) with disks or plows on 2 to 8 percent slopes in South Africa.

4176. Gilman, H. H. WHAT IS A TERRACE? Nebr. Agr. Col. Ext. EC 63-143, 6 pp. Ref. 1963. 275.29 N272Ex

An illustrated guide was given on the construction and use of terraces in Nebraska.

4177. Gilman, H. H. WHAT IS A GRASSED WATERWAY? Nebr. Agr. Col. Ext. EC 63-144, 6 pp. Ref. 1963. 275.29 N272Ex

An illustrated guide was given on the construction and use of grassed waterways in Nebraska.

4178. Gilman, H. H. CONTOUR BENCH LEVELING. Nebr. Agr. Col. Ext. EC 63-155, 6 pp. Ref. 1963. 275.29 N272Ex

An illustrated guide was given on the construction and use of contour bench leveling in Nebraska.

4179. Gilst, W. J. Van. MECHANICAL DRAINAGE. (Du) Landbouwmechanisatie 12(10): 714-718. Oct. 1961. 58.8 L2352

4180. Gilst, W. J. Van. EQUIPMENT FOR LAND IMPROVEMENT IN THE NETHERLANDS. II. (Du) Landbouwmechanisatis 14(10): 839-848. (Cont.) Oct. 1963. 58.8 L2352

4181. Gilst, W. J. Van. EQUIPMENT FOR LAND IMPROVEMENT IN THE NETHERLANDS. IV. (Du) Landbouwmechanisatie 14(12): 1055-1059. Dec. 1963. 58.8 L2352

4182. Gjefsen, G. SELECTION OF DRAINAGE PIPES THIS FALL. (No) Norsk Landbr. 20: 672-673. Sept. 28, 1962. 11 N8122

4183. Glerum, J. C. MECHANIZATION OF RECLAMATION. (Du) Landbk. Tijdschr. 73(15): 754-765. Sept. 1961. 105.2 Or 3

4184. Golikov, A. V. WATER DISCHARGE PIPE WITH THE CAM LOCK. (Rus) Gidrotekh. i Melior 8(4): 42-45. Apr. 1956. 290.8 G362

4185. Gorinskii, V. N. MECHANIZATION OF OPERATIONS CONNECTED WITH THE LAYING OF DRAINAGE PIPES WITHOUT DIGGING TRENCHES. (Rus) Tekh. v Sel'sk. Khoz. 1962(7): 88-92. July 1962. 58.8 M11

4186. Gorinskii, V. N. APPLICATION OF PLASTIC TUBES IN DRAINAGE AND MECHANIZATION OF DRAINAGE CONSTRUCTION ABROAD. (Rus) Gidrotekh. i Melior. 2: 39-48. Ref. Feb. 1963. 290.8 G362

4187. Gorinskii, V. N. MECHANIZATION OF THE CONSTRUCTION OF IRRIGATION CANALS AND CLOSED DRAINAGE. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 7: 81-86. Ref. July 1963. 20 V633

4188. Gothe, H. NEW DIAGONAL STEEL GUTTERS FOR WATER DRAINAGE FROM FOREST ROADS. (Ge) Allg. Forstz. 17(16): 352. Apr. 21, 1962. 99.8 AL52

4189. Goulding, P. F. MOLE DRAINAGE ON PEAT. New Zeal. J. Agr. 102(3): 263-264. Mar. 15, 1961. 23 N48J

A cheap, effective, and easily made tractor mounted mole plow used in New Zealand peat areas was described and illustrated.

4190. Grant, A. J. AUTOMATIC SYPHONIC SPILLWAYS. Internatl. Comn. Irrig. & Drain. Annu. B. 1959: 8-18. 1959. 55.9 In8A

A report was given on the use of automatic syphonic spillways in Australia to limit the full supply levels in irrigation channels and automatically dispose the surplus flow into adjacent drainage channels. The types described were designed and constructed in the field.

4191. Grimm, K., and Ow, R. Von. MACHINERY FOR CONSTRUCTING AND CLEANING OF WASTE WATER DITCHES. (Ge) Dlz-Deut. Landtech. Z. 9(6): 232-234. June 1958. 58.8 T677

4192. Grimm, K., and Ow, R. Von. USE OF MACHINES IN CONSTRUCTING AND CLEANING OF SEWAGE DITCHES. (Ge) Dlz-Deut. Landtech. Z. 9(8): 294, 296, 298. Aug. 1958. 58.8 T677

4193. Grodau, G. RECENT DEVELOPMENT OF MACHINERY AND EQUIPMENT FOR WATER MANAGEMENT WORKS IN GERMANY AND ABROAD. (Ge) Wasser u. Boden. 11(4): 87-102. Ref. Apr. 1959. 56.8 W28

4194. Groves, E. R. THEIR FINDING NEW CHEAP DRAINAGE METHOD. Ohio Farmer 225: 12. June 18, 1960. 6 Oh3

One of the newest ideas for lowering the cost of draining farm land is an invention of Date and Floyd Summers, two dairy farmers of Trumball Co., Ohio.

Stated simply the machine places a strip of slag or gravel in the soil below plow level, with use of a subsoiler that has been remodeled.

It is not a system that will replace standard drain tile. It will be valuable to drain corners too short for a tiling machine; for occasional low spots between tile lines; and for places that need some help during the wettest part of the year, where extensions of the tile system doesn't seem practical.

4195. Gudalin, V. I. MECHANIZATION OF DEALING WITH STEEP SLOPES. (Rus) Sadov. Vinograd. i Vinodel. Moldavii 14(4): 56-59. July/Aug. 1959. 80 Sa15

4196. Guillot, R. PIPELINES OF PLASTIC MATERIALS AND THEIR USE IN OVERSEAS TERRITORIES. (Fr) Cong. Internatl. de Chim. Indus. Compt. Rend. 31(2): 747-750. 1958. 383 C42C

4197. Gurvich, I. I. UTILIZATION OF EXCAVATORS IN FOREST DRAINAGE WORKS. (Rus) Lesn. Khoz. 8(7): 59-64. July 1955. 99.8 L5622

4198. Gusev, S. HIGHLY PRODUCTIVE EXCAVATING MACHINERY FOR IRRIGATED FARMING. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 3: 54-56. 1964. 20 M57

4199. Hakansson, A. WHAT DO YOU KNOW ABOUT DRAINAGE WITH PLASTIC PIPES? (Sw) Lantmannen 75(15): 379-381. Apr. 11, 1964. 11 L234

4200. Hallgren, G. DRAINAGE WORKERS AND MACHINERY TECHNICIANS MUST COOPERATE. (Sw) Jord och Skog 15(2): 72-74. 1963. 58.8 M373

4201. Hamalainen, M. S. A NEW FINNISH DITCHING PLOW. (Sw) Skogen [Stockholm] 43: 396-397. July 1, 1956. 99.8 Sk51

4202. Harildstad, E. COVERING MATERIALS FOR TILE DRAINAGE DITCHES. (No) Norsk Landbr. 22: 582-584, 587. Oct. 23, 1959. 11 N8122

4203. Harildstad, E. DRAINAGE PIPES OF PLASTIC. (No) Norsk Landbr. 17: 551, 566. Aug. 18, 1961. 11 N8122

4204. Harildstad, E. USE OF PLASTIC DRAINAGE PIPES. (No) Norsk Landbr. 20: 662-663. Sept. 28, 1962. 11 N8122

4205. Harildstad, E. PLASTIC DRAINAGE PIPES. (No) Ny Jord 51(3): 91-105. June 1964. 282.28 N98

4206. Harrison, D. S. A TOOL BAR MOUNTED MOLING IMPLEMENT. Fla. Agr. Expt. Sta. C. S-115, 7 pp. July 1959. 100 F66Ci

A tool bar mounted moling instrument was described and illustrated.

4207. Hassed, R. D. DITCH BLASTING WITH EXPLOSIVES. Canterbury Chamber Com. Agr. B. 370, 6 pp. May 1960. 23 C162

A report was given on the advantages of ditch blasting with explosives in New Zealand to drain extremely wet areas.

4208. Hatt, J. LET'S GO LAND DRAINING. Pract. Power Farming 29(4): 10-11. Oct. 1962. 58.8 P872

An illustrated report was given on the machinery requirements for drainage construction work in Great Britain.

4209. Haugen, O. ORIENTATION ON EXPERIENCES IN MECHANICAL DRAINAGE. (No) Nord. Jordbrforsk. 39(1/2): 101-105. 1957. 11 N752
Discussion, p. 113-114.

4210. Haws, F. W., and Lauritzen, C. W. FOR LINING DITCHES WITH CONCRETE, NEW SLIPFORM USES FREE-FLOW HOPPER. Farm & Home Sci. [Utah Sta.] 23(3): 63-65. Sept. 1962. 100 Ut1F

A report was given on the use of a slipform free-flow hopper for lining irrigation ditches with concrete for seepage control in Utah.

4211. Haynes, H. D. MACHINES FOR SURFACE DRAINAGE: I. LAND AND WATER CONTRACT. 3(8): 10-11, 14-15. 1961. 56.8 L222

A report was given on machines for rough grading for surface drainage in humid areas of the United States.

4212. Haynes, H. D. MACHINES FOR SURFACE DRAINAGE. II. LAND AND WATER CONTRACTING 3(9): 14-15, 18. 1961. 56.8 L222

A report was given on machines for finish grading and continuing maintenance for surface drainage in humid areas of the United States.

4213. Haynes, H. D. MACHINES FOR SURFACE DRAINAGE. III. LAND AND WATER CONTRACT. 3(10): 10-11. 1961. 56.8 L222

A report was given on the costs of machine grading for surface drainage in the United States.

4214. Heese, K. SETTING UP MACHINE SYSTEMS FOR MELIORATION AFFAIRS (DRAINAGE). Deut. Agrartech. 9(4): 161-169. Apr. 1959. 58.8 D482

4215. Heese, K. MACHINE SYSTEMS OF MELIORATION TECHNIQUE. (Ge) (Abs.) Deut. Landwirt. 11(1): 45. Jan. 1960.

4216. Heese, K. MELIORATION MACHINES (DRAINAGE). (Ge) Berlin, Verlag Technik, 82 pp. 1961. 58 H364

4217. Heino, E. SEVERAL SUGGESTIONS FOR THE IMPROVEMENT OF FOREST DITCH PLOUGHS. (Fi) Suo 12(6): 89-94. Apr. 30, 1962. 54.8 Su7
English summary.

A report was given on several suggestions for the improvement of forest ditch plows used in Finland.

4218. Heppner, M. B. FILLED-CHANNEL DRAINAGE. Farm Q. 15(4): 78, 146. Nov./Jan. 1960/61. 6 F22995

A report was given on a machine to drop gravel into a channel through a tube on the subsoiler. The gravel layer is covered with paper to prevent the channel from silting up. The machine is usually used with tile drainage.

4219. Herpich, R. L., and Manges, H. L. IRRIGATION WATER CONTROL STRUCTURES. Kans. State U. Engin. Ext. Dept. Land Reclam. 7, 12 pp. 1959. 275.29 K 13 EnL

New irrigation methods and devices are a result of demand from irrigators for better ways of controlling water and an increasing desire to save labor. With the development and application of new techniques of land grading there came a demand for water-control structures that could be installed permanently. These included: Pump division boxes; diversion boxes; drops; and checks.

Some of the requirements for water-control structures are: (1) Their use must reduce the labor requirements for applying the irrigation water; (2) they must present minimum interference to normal farming operations; (3) their use must not allow excessive erosion; (4) they must be simple to install and operate; and (5) their cost must not be excessive.

4220. Hjalmarsson, B. SOME OBSERVATIONS ON THE CONSTRUCTION AND USE OF THE SO-CALLED PARTLY COVERED DRAINAGE OUTLET. (Sw) Grundforbattring 12(4): 231-236. 1959. 54.8 G92

4221. Holjewilken, H. OPERATING METHODS AND MACHINERY FOR CLAY PIPE DRAINAGE. (Ge) Deut. Agrartech. 14(1): 6-8. Jan. 1964. 58.8 D482

4222. Honeyfield, H. R. EFFECT OF BREATHERS ON FLOW CHARACTERISTICS IN TILE DRAINS LAID ON STEEP SLOPES. (Abs.) Purdue U. Engin. Expt. Sta. Res. Ser. 140:L8. 1959. 290.9 P97E

A study was made of the use of breathers at the beginning of steep slopes and at every 1/4 mile on long mains for tile drains.

For heads greater than the tile diameter but less than 1.5 tile diameters, greater discharge was obtained without breathers. The conventional method of using a breather at the beginning of a steep slope and at a relief well at the foot of the slope was recommended as a good practice.

4223. Horansky, J. TECHNOLOGICAL SCHEMES CONCERNING THE MECHANIZATION OF TERRACING WORKS. (Rum) Gradina, Via si Livada 12(1): 67-70. Jan. 1963. 80 G75

4224. Hove, P. NEW TRENDS IN DRAINAGE. (No) Norske Myrselsk. Meddel. 58(6): 162-169. Dec. 1960. 11 N813

4225. Hove, P. LABORATORY TESTING OF DRAINAGE MATERIALS. (No) Norges Landbrukshogsk. Meld. 43(10), 99 pp. 1964. 104 N762M
English summary.

Laboratory tests in Norway were reported on the silting risk and efficiency of drains by using various pipes and binding materials.

4226. Hudson, A. W., and Bowler, D. G. SUGGESTIONS FOR FARMER-OWNED DRAINAGE SERVICES. Massey Agr. Col. Sheepfarming Annu. 1955: 7-16. 1955. 45.9 M38A
Includes discussion.

A talk and discussion were given where the suggestion was made that "Farmer-owned" drainage service be provided in Australia. Costs and operation of such a system were given along with the equipment needed.

4227. Hiikari, O. MECHANIZATION OF FOREST DITCH DIGGING IN FINLAND. (Sw) Norsk Skogbruk 3(8): 219-220. Apr. 1957. 99.8 N815

4228. Ignatenok, F. V. PLANK BOARDS WITHOUT PEGS. (Rus) Gidrotekh. i Melior. 7(7): 42-46. July 1955. 290.8 G362

4229. Ignatenok, F. V. THE TRENCHLESS DRAIN-LAYER. (Rus) Gidrotekh. i Melior. 11(4): 26-31. Apr. 1959. 290.8 G362

4230. Instituut Voor Landbouwtechniek en Rationalisatie. Afdeling Mechanisatie Cultuurtechniek. SOME ASPECTS OF MECHANICAL DIGGING AND BROADENING OF DITCHES TO BE CONSIDERED. (Du) Wageningen, Inst. v. Landbtech. en Ration. Gestencilde Meded. 1, 21 pp. 1962. 58.9 W12G

4231. Isidoro, G. THE APPLICATIONS OF PLASTIC PIPES IN AGRICULTURE. (It) Acqua e il Suolo 11(1): 37-51. Ref. Jan./Feb. 1959. 55.8 Ac7
English summary.

A discussion was given of the hydraulics of plastic pipes that are used in agriculture.

4232. Iunevich, D. P., and Levin, M. G. ASPHALT-GRAVEL DRAIN PIPES. (Rus) Gidrotekh. i Melior. 7(5): 24-28. May 1956. 290.8 G362

4233. Ivanov, S. A. USE OF PLASTIC MATERIAL IN IRRIGATION. (Rus) Khlopkovodstvo 4: 46-47, 50. Apr. 1964. 72.8 K522

4234. Jaakkola, O. MACHINES TO HELP IN THE DRAINAGE OF FIELDS. (Fi) Teho 7/8: 381-382, 410. 1961. 20 T98
English summary, p. 412.

A report was given on the use of machines to clean the main drainage ditches in Finland to improve their efficiency.

4235. Jager, A. W. De. PLASTIC PIPE ENDS. (Du) Nederland. Heidemaatsch. Tijdschr. 70(2): 38-42. Feb. 1959. 12 N282

4236. Jager, A. W. De. PLASTIC DRAINAGE PIPES. (Du) Nederland. Heidemaatsch. Tijdschr. 71 (7/8): 194-200. July/Aug. 1960. 12 N282

4237. Jager, A. W. De. DRAINAGE WITH PLASTIC PIPES. Cong. Irrig. & Drain. Trans. 5(5): R.17.267-R.17.278. 1963. 55.9 C7652

A report was given on the use of plastic pipes of hard p.v.c. (polyvinyl chloride) covered with fiber glass filter material in Holland.

4238. Janert, H. THE GRIEFSWALDER PIPE-LAYING MACHINE AND ITS OPERATION. (Abs.) Agr. Engin. 40(2): 109. Feb. 1959. 58.8 Ag83

An abstract was given of an article translated from German. A pipe-laying machine was described that lays pipe in the soil for drainage and sub-irrigation. The pipe is made from a prepared plastic sheet.

4239. Jerven, O. MECHANICAL FOREST DRAINAGE. (No) Skogeieren 49(5): 5. May 1962. 99.81 Sk5

4240. Jonkers, G. A. MECHANICAL DRAINAGE. (Du) Nederland. Heidemaatsch. Tijdschr. 67: 199-207. Sept. 1956. 12 N282

4241. Juusela, T. ON THE POSSIBILITIES FOR USING TRENCH DIGGING MACHINES IN FINLAND. (Sw) Nord. Jordbrforsk. 39(1/2): 110-113. 1957. 11 N752
Discussion, p. 113-114.

4242. Kagan, D., and Ekhlakov, S. POLYETHYLENE HOSES AND METHODS OF THEIR COUPLING. (Rus) Tekh. v Sel'sk. Khoz. 7: 88-93. July 1964. 58.8 M11

4243. Kampet, G. USE OF EXPLOSIVES IN MELIORATION. (Ge) Deut. Agrartech. 11(1): 18-20. Jan. 1961. 58.8 D482

4244. Karlovskii, V. USE OF EXCAVATORS IN LAYING TILE DRAINAGE SYSTEM. (Rus) Tekh. v Sel'sk. Khoz. 3: 37-38. Mar. 1964. 58.8 M11

4245. Kazakov, V. DRAINAGE WITHOUT DIGGING A TRENCH. (Rus) Tekh. v Sel'sk. Khoz. 10: 42-43. Oct. 1964. 58.8 M11

4246. Kelsall, D. F., Crockford, R. H., and Davey, E. T. DEVELOPMENT OF A MACHINE FOR THE DISSOLUTION OF GYPSUM. J. Agr. Engin. Res. 5: 355-362. 1960. 56.8 J82

An account was given of the development of a machine for the efficient continuous dissolution of commercial gypsum in irrigation water.

4247. Kim, P. M. NON-FRAMED BLOCK FILTERS FOR BORE HOLES. (Rus) Gidrotekh. i Melior. 1960 (1): 39-44. Jan. 1960. 290.8 G362

4248. Kirtbaya, Y. K., and Sheiko, E. P. STUDY OF THE TECHNOLOGY OF MECHANICAL SLOPE TERRACING. (Rus) Vest. Sel'skokhoz. Nauki [Moscow] 6: 112-119. June 1963. 20 V633
English summary.

A report was given on the mechanical terracing of steep slopes in the Ukraine area of U.S.S.R.

4249. Kistenfeger, J. NEW INSTALLATION, MAINTENANCE AND REPAIR OF DITCHES WITH THE TRENKLE-DITCH SHOVEL. (Ge) Allg. Forstz. 19(42): 641-643. Oct. 17, 1964. 99.8 AL52

4250. Klose, B. TECHNICAL AND ECONOMIC EXPERIENCES IN REGARD TO THE DIGGING OF CANALS WITH A BIG DIGGING MACHINE AND LEVELING OF MARSHLAND IN VESTERALEN, NORDLAND. (No) Ny Jord 44(1): 21-28. 1957. 282.28 N98

4251. Knapp, C. J. THE DITCH YOU CAN CARRY. Monsanto Mag. 36(3)L 4-7. June/July 1956. 309.8 M75

A report was given on the use of plastic pipes for irrigation ditches for both transmission and distribution of water.

4252. Knapp, C. J. THE DITCH YOU CAN CARRY. Queensland. Bur. Sugar Expt. Sta. Cane Growers' Q. B. 20(3): 78-80. Jan. 1, 1957. 65.9 Q3C

The use of plastic pipe for irrigation ditches was given for Queensland, Australia.

4253. Knust, H. G. WATER DISTRIBUTORS. Queensland Bur. Sugar Expt. Sta. Cane Growers' Q. B. 21(4): 120-121. Apr. 1, 1958. 65.9 Q3C

The use of polythene tubing for irrigation was explained for Queensland, Australia.

4254. Kocherga, F. K., and Serikov, I. M. MECHANIZED ESTABLISHMENT OF TERRACES ON THE MOUNTAIN SLOPES OF CENTRAL ASIA. (Rus) Lesn. Khoz. 9(6): 52-59. June 1956. 99.8 L5622

4255. Kohler, D. MECHANIZATION OF MELIORATION WORKS AND PRACTICAL EXPERIENCES GAINED SO FAR. (Ge) Deut. Agrartech. 7(9): 413-415. Sept. 1957. 58.8 D482

4256. Kohler, D. POSSIBILITIES FOR THE USE OF EXISTING TECHNIQUE BY THE MELIORATION DIVISIONS OF THE MTS [MACHINE TRACTOR STATIONS]. (Ge) Deut. Agrartech. 9(4): 174-176. Apr. 1959. 58.8 D482

4257. Koivisto, A. A. TIME STUDY FIGURES IN DITCH DIGGING BY PLOW FOR FORESTRY PURPOSES. (Fi) Metsataloudellinen Aikakauslehti 1: 31, 33-34. 1956. 99.9 F49
English summary.

Ditch digging by tractor and plow for forests in Finland was cheaper than digging by hand. Clearing and maintenance of ditches was less for the hand labor.

4258. Kokovin, E. V., and Neznaev, M. F. MECHANIZATION OF WORK IN DRAINAGE AND LAND RECLAMATION. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel' skokhoziaistvennoi Literatury. 390 pp. 1956. 54 K82

4259. Kop'ev, E. I. MOUNTED MOLE DIGGER. (Rus). Gidrotekh. i Melior. 10(1): 54-58. Jan. 1958. 290.8 G362

4260. Kop'ev, E. I. MECHANIZATION OF MOLE DRAIN CONSTRUCTION FOR REGULATING SUBSURFACE IRRIGATION. (Rus) Vest. Sel'skokhoz. Nauk 3(6): 108-115. June 1958. 20 V633
English summary.

A description of an original mole plow designed to establish mole drains with artificially reinforced underground walls (concrete) was given and compared with existing mole plows and mole plow machinery.

Some data were given on the practical work on the reinforced mole drains for subsurface irrigation.

4261. Kop'ev, E. I. MOLE PLOUGH KH-700 MOUNTED TO A TRACTOR. (Rus) Gidrotekhnika i Meliorazia 12(7): 43-46. July 1960. 290.8 G362

4262. Kop'ev, E. I. NEW DRAINAGE MACHINERY. (Rus) Tekh. v Sel'sk Khoz. 9: 42-46. Sept. 1963. 58.8 M11

4263. Kornay, J. IRRIGATION WITH PLASTIC PIPES. (Hu) Magyar Mezogazdasag 18(34): 14-15. Aug. 21, 1963. 19 M27

4264. Kostov, M. MECHANIZED TERRACING OF SLOPES. (Bu) Sofiia, Zemizdat, 124 pp. 1959. 58 K842

4265. Kovalenko, I. I. USE OF PLASTIC MATERIAL IN DRAINAGE OF EXCESSIVELY MOIST LANDS. (Rus) Gidrotekh. i Melior. 8: 15-26. 1964. 290.8 G362

4266. Kozaliev, G. ORGANIZATION AND MECHANIZATION OF WORK IN DITCH CONSTRUCTION OF IRRIGATION SYSTEMS. (Bu) Ikonomika Mekh. Selsk. Stopanstvo 1(2): 65-76. 1964. 281.8 Ik7

4267. Kratynskii, V. MACHINERY FOR DRAINAGE OF MARSHES. (Rus) Tekh. v Sel'sk Khoz. (7): 38-40. July 1961. 58.8 M11

4268. Krolis, K. E., and Gilst, W. J. Van. EQUIPMENT FOR LAND IMPROVEMENT IN THE NETHERLANDS. V. (Du) Landbouwmechanisatie 15(1): 47-48. Jan. 1964. 58.8 L2352

4269. Kryzhanovskii, A. I. UTILIZATION OF MACHINERY FOR RECLAMATION OF MARSHY AND FLOODED LAND. (Rus) Barnaul, Altaiskoe Knizhnoe Izdatel'stvo, 57 pp. 1956. 58 K943

4270. Kuntze, H. TECHNICAL DEVELOPMENTS IN THE USE OF DRAINAGE MACHINERY. (Ge) Tech. u. Landwirt. 12(8): 180-184. Apr. 25, 1960. 58.8 T223

4271. Kuntze, H. PLASTICS IN DRAINAGE TECHNIQUE. (Ge) Tech. u. Landwirt. 13(8): 169-171. Apr. 25, 1961. 58.8 T223

4272. Kuntze, H. PLASTICS IN THE DRAINAGE TECHNIQUE. (Ge) Tech. u. Landwirt. 15(1): 12-14. Jan. 10, 1963. 58.8 T223

4273. Kuntze, H. MODERN DRAINAGE EXPERIMENTS. (Ge) Lohnunternehmen in Land- u. Forstwirt. 18(4): 74-76. Apr. 15, 1963. 58.8 D81

4274. Kuntze, H. UTILIZATION POSSIBILITIES FOR VACUUM TANKS. (Ge) Tech. u. Landwirt. 15(8): 182-184. Apr. 25, 1963. 58.8 T223

4275. Kuntze, H. PLASTICS IN DRAINAGE TECHNIQUE. (Ge) Mitt. der Deut. Landwirt.-Gesell. 79 (5): 111-113. Jan. 30, 1964. 18 N39

4276. Kurbatov, N. D. EXPERIMENT WITH THE CONSTRUCTION OF TILE DRAINAGE SYSTEM WITH THE USE OF CANAL DIGGERS. (Rus) Gidrotekh. i Melior. 12: 44-45. Dec. 1964. 290.8 G362

4277. Kuz'michev, V. E., and Nesterenko, I. M. USING EXCAVATORS ON RECLAMATION JOBS IN WINTER. (Rus) Gidrotekh. i Melior. 10(2): 50-52. Feb. 1957. 290.8 G362

4278. Lang, P. NEW PLIABLE, PLASTIC IRRIGATION PIPE PUTS WATER WHERE YOU WANT IT. West. Fruit Grower 18(11): 10-12. Nov. 1964. 95.8 G762

A report was given on the use and economics of use of pliable plastic irrigation pipes in California.

4279. Larsen, S. DRAINAGE. (Da) Hedeselsk. Tidsskr. 84(14): 346-355. Nov. 15, 1963. 11 H35

4280. Larson, C. L., and Hersmeier, L. F. DEVICE FOR MEASURING PIPE EFFLUENT. Agr. Engin. 39 (5): 282-284, 287. May 1958. 58.8 Ag83

An improved method for measuring pipe effluent was described and illustrated. The slotted-tube flow meter cannot be used to measure flow which carries debris, such as surface runoff or sewage. However, a moderate amount of sediment does not interfere with its operation. The following merits of the slotted-tube flow meter were given: (1) It is a relatively simple device that has no moving parts; (2) it is not sensitive to minor deviations in fabrications, other than the diameter of the test pipe; (3) it can be used to measure a wide range of discharges, including low flows, with good accuracy; and (4) it has a small head loss.

4281. Lauritzen, C. W. LAY-FLAT TUBING: A PROMISING IRRIGATION DEVELOPMENT. Utah Farm and Home Sci. 18: 68-70. 1957. 100 UT1F

Tests with lay-flat tubing for conveying and distributing water were started at Logan, Utah, about 10 years ago. The name, lay-flat, is used to designate a tubing which lies flat when empty. Materials used in the construction of this tubing have included canvas, supported and unsupported plastic fabrics, and now butyl. When used to convey water, lay-flat tubing assumes a rounded shape, the degree of roundness depending on the internal pressure. A hydrostatic head of about four pipe diameters is necessary to give the tubing a fully round cross section.

4282. Lehmann, T. DRAINAGE TECHNIQUE ON STONY SOILS. (Ge) Deut. Agrartech. 14(1): 19-21. Jan. 1964. 58.8 D482

4283. Lhotsky, J., and Ferda, J. NOTES ON MECHANIZATION OF IMPROVEMENT WORKS IN FORESTRY. (Cz) Ceskoslov, Akad. Zemedel. Ved. Sborn. Lesn. 34(11): 1051-1060. Ref. Nov. 1961. 99.9 C334
English summary.

A report was given on drainage and site preparation work planned to improve forests in Czechoslovakia. The machinery to be used for the project was discussed.

4284. Lie, O. NEW EXPERIENCES WITH DRAINAGE OF MARSHES. (No) Norske Myrselsk. Meddel. 61(4): 89-98. Aug. 1963. 11 N813

4285. Lillandt, S. MECHANICAL FOREST DITCHING. (Sw) Skogsbruket 30(9): 227-229. 1960. 99.8 Sk59

4286. Lindqvist, R. DRAINAGE PROBLEMS IN THE PLASTIC AGE. (Sw) Malmohus Lans Hushsallsk. Kvrtlskr. 2: 184-190. 1964. 11 M29

4287. Listo, T. PRELIMINARY DRYING OF WET PEAT LANDS. (Fi) Metsataloudellinen Aikakauslehti 80(10): 417-418, 430. Oct. 1963. 99.9 F49
English summary, pp 430

A report was given on the use of a tractor driven milling machine developed in Lapland for digging "navero" drains during the winter for the first drying of wet peat lands in Finland. In the following summer, the main drains can be dug with a broad track excavator.

4288. Livingston, A. C. Control gates for irrigation and drainage projects. Cong. Irrig. & Drain. Trans. 4(6): C.33-C.67. 1960. 55.9 C7652

An illustrated report was given on control gates used in Great Britain for irrigation and drainage projects.

4289. Lloyd, D. DITCH DIGGERS TAKE TO THE HILLS. Pract. Power Farming 28(6): 10-11. June 1962. 58.8 P872

An illustrated report was given on the machinery exhibited at a drainage machinery demonstration in Wales for the construction and maintenance of drainage ditches.

4290. Lockert, K. THE VIKEIDPLOW--A REVOLUTION IN MARSH CULTURE. (No) Norsk Landbr. 5: 96-97, 116-117. Feb. 26, 1960. 11 N8122

4291. Lockhart, J. M. SURFACE DRAINAGE IN WESTLAND. New Zeal. J. Agr. 100(2): 151, 153. Feb. 15, 1960. 23 N48J

A spinner surface drainer used in New Zealand was described and illustrated.

4292. Loebell. MECHANIZATION OF DRAINAGE WORK. (Ge) Kuratorium f. Kultbauw. Jahresversamml. 18-27. 1959. 290.9 K96

4293. Loebell, R. DRAINAGE MACHINERY; GENERAL REPORT (Ge) Internatl. Cong. Agr. Engin. Trans. 5(1): 101-114. 1958, pub. 1960. 290.9 C765C
English summary.

A report was given on the machinery used for tile and mole drainage. Special problems of using the machinery were discussed.

4294. Look, E. H. THE PAST AND POTENTIAL OF PLASTIC PIPE. Irrig. Engin. & Maintenance 11(9): 12-13. Oct. 1961. 55.8 Ir722

A non-technical report was given on the past and potential use of plastic pipe for irrigation systems.

4295. Luik, H. MECHANICAL DIGGING OF DITCHES. (Sw) Västerbotten 32(6): 147-149. Nov. 1959. 11 V442

4296. L'Vin, N. S. PREPARATION OF TERRACES USING PLOWS. (Rus) Sadovodstvo 4:8-10. Apr. 1963. 80 Sa13

4297. MacIntyre, I. M., and Kalbfleisch, W. MECHANIZED DIKELAND DRAINAGE. Res. Farmers 8(2): 8-9. Spring 1963. 7 R31

A report was given of mechanized dikeland draining in maritime marshland in Canada for the construction and maintenance of open ditches.

4298. Maijala, K. MAIN DRAINAGE DITCHES AND THEIR CONSTRUCTION. (Fi) Teho 10: 524-527. 1956. 20 T98
English summary, pp. 534.

Ditch digging plows developed in Finland for installing main drainage ditches were described and illustrated.

4299. Maijala, K. MECHANIZED RECLAMATION OF SWAMPLANDS IN FINLAND. Suomen Maataloustiet. Seura. Maataloustiet. Aikakausk. 28: 58-68. 1956. 20 Su7M

A report was given on the use of machinery for the reclamation of swampland. Use of machinery for making open ditches in the peat lands and mineral soils were described and illustrated.

4300. Maike, P. M. DRAINAGE AND CONSTRUCTION OF ROADS IN FORESTS. (Rus) Lesn. Khoz. 8: 10-13. Aug. 1963. 99.8 L5622.

4301. Makhkamov, K. EXPERIMENT IN USE OF ELASTIC, MOBILE TUBES FOR COTTON IRRIGATION. (Rus) Tashkent. Nauch.-Issled. Inst. po Khlopkov. Sborn. Nauch. Rabot Aspirantov SoyuzNIKHI 3: 100-108. 1962. 72.9 T182Sb

4302. Malmerot, B. FIELDS FOR EQUIPMENT. (Sw) Norrbottens Lantmannabl. 5: 116-117. July/Aug. 1960. 11 N792

4303. Mamedov, A. VARYING THE SETTING OF THE WORKING-PART OF THE DITCH-DIGGER. (Rus) Tekh. v Sel'sk. Khoz. 1962(7): 50-51. July 1962. 58.8 M11

4304. Manley, P. L. PLASTIC DRAIN LINERS EVALUATED BY PNEUMATIC TEST CHAMBER. Agr. Engin. 41(12): 824. 1960. 58.8 Ag83

A pneumatic test chamber that is used to evaluate plastic drain liners was described and illustrated.

4305. Manson, P. W. RESEARCH HAS IMPROVED DRAIN TILE. Minn. Farm & Home Sci. 18(1): 7, 15. Fall 1960. 100 M668

A report was given on the research in Minnesota to improve clay and concrete drain tile.

4306. Markov, P. V. THE WATER-SUPPLY PAVILION; GUIDE-BOOK. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Kul'turno-Prosvetitel'noi Literatury, 1955. 47 pp. 1955. 55 M34

4307. Masek, V., and Kral, V. UTILIZATION OF MECHANIZED EQUIPMENT FOR DRAINAGE OF SOILS. (Cz) Czechoslovakia. Min. Zemedel. Lesn. a Vodniho Hospodar. Ust. Vedtech. Inform. Zemedel. Tech. 35(3): 147-172. June 1962. 58.9 C333
German and Spanish summaries.

4308. Matsepuro, M. COMPLEX MECHANIZATION OF THE PROCESSES OF THE DEVELOPMENT OF MARSHES AND MARSH LANDS IN USSR. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 1958(3): 99-106. 1958. 20 M57

4309. Matsepuro, M. MECHANIZED LAND IMPROVEMENT. (Pol) Nowe Roln., Jan. 1962(spec. no.): 50-52. Jan. 1962. 20.5 N86

4310. Matsepuro, M. E., and Turetskii, R. L. PATHS OF THE FUTURE DEVELOPMENT OF RECLAMATION EQUIPMENT. (Rus) Traktory i Sel'khozmash. 8: 20-22. Aug. 1962. 58.8 T68

4311. Matthews, J., and Harries, G. O. AUTOMATIC GRADIENT CONTROL SYSTEM FOR DRAIN-LAYING MACHINES. J. Agr. Engin. Res. 9(3): 235-240. 1964. 58.8 J82

A description was given of an automatic gradient control system, based on an optical beam reference, and suitable for use with drain-laying or earth-levelling machinery.

The performance of the system incorporated on a tractor-hauled drain laying machine had an accuracy of ±1 inch.

4312. Mayo, K. L. THE MOLE PLOUGH AND ITS FUNCTION. New Zealand J. Agr. 103: 69. July 15, 1961. 23 N48J

A report was given on the construction and use of a mole plow in New Zealand.

4313. Mazzini, C. DITCH DIGGING EQUIPMENT IN AGRICULTURE. (It) Agr. Ferrarese 65(8): 146-149. Aug. 31, 1961. 16 Ag87

4314. Mehnert, K. WHAT SHOULD BE OBSERVED IN THE CREATION AND MAINTENANCE OF DITCHES? (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 3(1): 27-29. Jan. 1962. 18 W763

4315. Mer, I. I. MACHINES FOR THE MECHANIZATION OF RECLAMATION WORKS. (Rus) Gidrotekh. i Melior. 8(8): 44-55. Ref. Aug. 1956. 290.8 G362

4316. Mer, I. I. MACHINES AND MOUNTING EQUIPMENT FOR THE CONSTRUCTION AND CLEANING OF CANALS AND PLANNING OF THEIR SLOPES (U.S.A.). (Rus) Gidrotekh. i Melior. 1960(6): 53-58. June 1960. 290.8 G362

4317. Mer, I. I. A MACHINE ASSEMBLY FOR APPLYING ANTI-FILTRATION ASPHALT SURFACES WITH A PROTECTIVE GROUND-ASPHALT COATING. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 56: 557-563. 1960. 20 M857

4318. Merbitz. PERPENDICULAR DRAINAGE. (Ge) Wasser u. Boden 8: 382-386. Nov. 1956. 56.8 W28

4319. Merkur'ev, I. S. AUTOMATION OF STRUCTURES ON RECLAMATION SYSTEMS. (Rus) Gidrotekh. i Melior. 6: 24-31. June 1963. 290.8 G362

4320. Messina, U. SELF-SUPPORTING PIPES.
101-116. Ref. Sept./Oct. 1960. 290.8 Ac7
English summary.

A report was given on the use of self-supporting pipe to carry irrigation water in Italy. An analysis was given of the elastic behavior of the pipes.

4321. Miller, W. T. WHICH KIND OF PIPE? II. CAST IRON. Golf Course Rptr. 32(6): 34-35. June 1964. 60.18 G83

A report was given on the installation and use of cast iron pipe and cement lined cast iron pipe for irrigation systems for turf.

4322. Moe, D. L. DRAINAGE, MACHINERY, AND EQUIPMENT. Internatl. Seminar Soil & Water Util. Proc. 1962: 214-216. 1962. 56.9 In86

The machinery and equipment needed for drainage of irrigated lands were discussed.

4323. Morishima, S., Matsuo, M., Kojima, K., and Ikemi, T. STUDIES ON THE MOLE PIERCERS. I. ANALYTICAL EXPERIMENTS OF THE MOLE-PIERCERS WITH VARIOUS WEDGE-SHAPED HEADS AND SQUARE SECTIONS. (Ja) Soc. Agr. Mach. Japan J. 26(3): 183-189. Dec. 1964.
English summary.

Various wedge shaped heads and square sections were tested for mole plows in Japan.

4324. Morishima, S., Matsuo, M., Kojima, K., and Ikemi, T. STUDIES ON THE MOLE-PIERCERS. II. ON THE MOLE PLOW DRAINER. (Ja) Soc. Agr. Mach. Japan. J. 26(3): 190-193, 166. Dec. 1964. 58.9 So1
English summary.

Various ball type heads were tested for mole plows in Japan.

4325. Mosienko, N. A. IRRIGATION IN THE KULUNDA STEPPE. (Rus) Zemledelie 3: 47-49. Mar. 1964. 20 Z44

4326. Muckel, D. C. NEW TECHNIQUES IN WATER MANAGEMENT. (Condensed.) Agr. Engin. 45(1): 34-35. Jan. 1964. 58.8 Ag83

A discussion was given on new techniques used in water management, especially those used for drainage and seepage control.

4327. National Institute of Agricultural Engineering. "BECFAB" DITCHER/DYKER. Natl. Inst. Agr. Engin. Rpt. Test 110, 13 pp. 1955. 58.9 N214R

A report was given on a "Becfab" ditcher-diker cleaner that consists of a scoop or bucket on a boom mounted at the rear of a tractor.

Unobstructed wet ditches up to about 10-12 feet in width at the top and about 5 feet deep could usually be done from one bank (and up to 15 feet wide from 2 banks).

4328. Nechetov, G. NEW LAND-RECLAMATION MACHINES. (Rus) Ekon. Sel'sk. Khoz. 1960(4): 88-91. Apr. 1960. 281.8 So73

4329. Nishanen, M. REDUCING THE COST OF DITCH DIGGING IN THE FOREST BY MEANS OF PLOUGHS AND POWER SHOVELS. (Fi) Teho 3/4: 110-113. 1964. 20 T98
English summary, pp 152.

A report was given on the economics of digging forest ditches by plows and power shovels in Finland.

4330. Niskanen, M. EXPERIENCES WITH TRACTOR DIGGING AGGREGATE AS FOREST DRAINAGE MACHINE. (Sw) Skogen [Stockholm] 51(11): 235-236, 238. May 28, 1964. 99.8 Sk51

4331. Nosov, A. V. MACHINES AND EQUIPMENT FOR DRAINAGE AND RECLAMATION OF BOGS AND MARSHY LANDS; GUIDE TO THE ALL-UNION AGRICULTURAL EXHIBITION. (Rus) Moskva, 75 pp. 1958. 54 N84

4332. Numminen, E. BASIC PRINCIPLES OF CLASSIFYING THE DIFFICULTY OF FOREST PLOUGH DITCHING OPERATIONS. (Fi) Suo 10(1): 3-12. Apr. 15, 1959. 54.8 Su7
English summary.

Samples were collected from 4.4 percent of the forest areas drained by plow ditching operations in 1957. The mean depth of the drains was 65 cm. The mean depth was reduced by: Stones; peat thickness; trees and residues of trees; bog type; and the Lukkala-Turkkonen's degree of spade digging difficulty.

4333. Numminen, E. AN INVESTIGATION ON THE EFFICIENCY OF FOREST TRENCHING MACHINES. (Fi) Suo 15(2): 25-36. Ref. Aug. 20, 1964. 54.8 Su7
English summary.

A report was given on an investigation of the efficiency of forest trenching machines in Finland.

4334. Obbink, J. G., and Seekamp, J. V. PLASTIC PIPES FOR SUB-SURFACE DRAINAGE INSTALLATIONS. Austral. Inst. Agr. Sci. J. 30(1): 29-32. Mar. 1964. 23 Au74

The use of different types of plastic pipes was discussed for subsurface drainage installations in Australia.

4335. O'Daniel, W., and Leendertz, B. A CONTRIBUTION TO THE CONSTRUCTION OF AN IRRIGATION LAYOUT WITH PLASTIC PIPES IN LOW STEM ORCHARD. (Ge) Erwerbsobstbau 5(12): 227-228. Dec. 1963. 80 Er9

4336. Olbertz, M. H. A NEW APPARATUS FOR THE REFINDING AND CLEANING OF DRAINAGE SYSTEMS. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(1): 25-28. Jan. 1964. 18 W763

4337. Olbertz, M. H. SITUATION AND FURTHER DEVELOPMENT OF DRAINAGE TECHNIQUE. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(1): 34-37. Jan. 1964. 18 W763

4338. Ol'Khovskii, I. A. FLAT GATE FOR PUMPING STATIONS OF CHAMBER TYPE. (Rus) Gidrotekh. i Melior. 5: 40-41. May 1964. 290.8 G362

4339. Ostrowski, J., and Sniadowski, Z. ATTEMPTS TO UTILIZE SYNTHETIC MATERIALS IN DRAINAGE WORKS. (Pol) Wiad. Melior. i Lakarskie 6(3): 72-73. May/June 1963. 54.8 W63

4340. Ovchinnikov, V. V. THE USE OF GLASS TUBES FOR AGRICULTURAL DRAINAGE. (Rus) Gidrotekh. i Melior. 7(9): 50-53. Sept. 1955. 290.8 G362

4341. Padoms, A. I. ON UTILIZATION OF MECHANISMS WHEN RECLAIMING LANDS IN LATVIAN SOVIET SOCIALIST REPUBLIC. (Rus) Gidrotekh. i Melior. 1960(9): 37-41. Sept. 1960. 290.8 G362

4342. Paivanen, J. DIGGING-TRACTORS IN FOREST DRAINAGE. (Fi) Suo 14(3): 41-43. Nov. 5, 1963. 54.8 Su7
English summary.

A report was given on the use and economics of use of digging-tractors for forest drainage in Finland.

4343. Palfai, I. BELOW THE SURFACE-PIPE SPRINKLING SYSTEMS. (Hu) Magyar Mezogazdasag 19(10): 16-17. Mar. 4, 1964. 19 M27

4344. Palmer, D. B., and Johnson, H. P. FIELD EVAPORATION OF FLOW THROUGH BLIND INLETS. Trans. ASAE 5(1): 58-61. 1962. 290.9 Am32T

Blind inlets are constructed by backfilling a tile trench with various gradations of material to increase the flow rate into the tile line and consequently reduce the time water stands in surface depressions. Four types of blind inlets (soil, sand, corncobs, and a combination of various sized materials) were compared in a field experiment over a 5-year period.

4345. Palmer, M. L. SELECTING GOOD DRAIN TILE. Ohio State U. Agr. Ext. B. 366, 7 pp. May 1958. 275.29 Oh32

A report was given on tests to select good drain tile for Ohio conditions.

4346. Panasenko, P. D. MANUFACTURING AND APPLICATION OF PRESTRESSED REINFORCED CONCRETE FLUME CANALS. (Rus) Gidrotekh. i Melior. 9: 47-53. Sept. 1963. 290.8 G362

4347. Panteleeva, N. N. RESULTS OF THE USE OF ELECTRICITY IN DRAINAGE. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 87: 159-164. 1963. 20 M857

4348. Pavlovskii, A. A. COMPLEX MECHANIZATION OF DRAINAGE WORK. (Rus) Vsesoiuzn. Obshch. po Rasprostranenifu Polit. i Nauch. Znanii. [Broshiury-Stenogrammy Lektsii]. Ser. 5, [Sel'skokhoz. Ser.] 9: 1-31. 1959. 20 V97

4349. Peiris, H. C. A NEW DEVELOPMENT IN MECHANIZATION. Ceylon Coconut Planters' Rev. 2(3): 10-12. Jan./Mar. 1962. 77.8 C333

A report was given on drainage equipment used in Ceylon for construction and maintenance of drainage ditches for coconuts.

4350. Pellizzi, G. FIRST EXPERIMENTAL TESTS OF DITCH DIGGERS. (It) Macch. & Motori Agr. 22 (12): 65-76. Dec. 1964. 58.8 M13

4351. Persson, S. SWEDISH EXPERIENCES WITH MECHANICAL TRENCH DIGGING IN RECENT YEARS. (Sw) Nord. Jordbrforsk. 39(1/2): 106-109. 1957. 11 N752
Discussion, pp. 113-114.

4352. Petlakh, Y. S. RECLAMATION MACHINES WITH DEVICES TO AUTOMATICALLY CONTROL BOTTOM GRADIENTS OF TRENCHES AND DRAINS. (Rus) Gidrotekh. i Melior. 196(1): 48-54. Jan. 1961. 290.8 G362

4353. Piironen, J. MECHANIZATION OF FOREST DRAINAGE. (Sw) Tidskr. f. Lantman och Andelsfolk 3: 58-60. Feb. 15, 1962. 20 T43

4354. Popov, K. V. HYDROTECHNICAL CONSTRUCTIONS. (Rus) Ed. 2, rev. and enl., Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury. 519 pp. 1956. (Uchebniki i Ucheb nye Posobiia dlia Sel'skokhoziaistvennykh Tekhnikumov) 290 P812

4355. Popov, O. S. THE ECONOMIC EFFECTIVENESS OF THE EXPLOSIVE METHOD OF DRAINING FORESTS IN SIBERIA. (Rus) Lesn. Khoz. 1962(5): 61-63. May 1962. 99.8 L5622

4356. Post, J., and Soet, F. De. MECHANIZED DRAINAGE AND IRRIGATION. (DU) Landbk. Tijdschr. 67: 595-607. Sept. 1955. 105.2 Or 3

4357. Pulatov, U. I. UTILIZATION OF THE OPEN PIT MULTI-BUCKET EXCAVATOR IN WATER CONSTRUCTION. (Rus) Gidrotekh. i Melior. 8(11): 42-45. Nov. 1956. 290.8 G362

4358. Pulatov, U. Y., Puzyrev, V. Y., Ivanov, S. A., and Abrarkhodzhaev, A. CONSTRUCTION OF AN IRRIGATION NETWORK OF FLUME-CANALS ON SUBSIDENCE SOILS IN THE GOLODNAYA STEP. (Rus) Gidrotekh. i Melior. 1961(10): 22-27. Oct. 1961. 290.8 G362

4359. Pyatetskii, G. E., and Gavrilenko, G. A. USE OF EXPLOSIVES FOR CONSTRUCTION OF DRAINAGE CANALS IN KARELIAN FORESTS. (Rus) Lesn. Khoz. 12: 8-10. Dec. 1964. 99.8 L5622

4360. Ragazzi, G. BRINGING UP TO DATE THE IMPROVEMENT OF DRAINAGE EQUIPMENT. (It) Prog. Agr. 4(8): 1011-1016. Aug. 1958. 58.8 P94

4361. Regamey, P. USE OF VARIOUS MATERIALS FOR DRAINAGE CONDUITS; GENERAL REPORT. (Fr) Internatl. Cong. Agr. Engin. Trans. 5(1): 115-127. 1958, pub. 1960. 290.9 C765C
English summary.

A report was given on the value of selecting the type of drainage conduits to fit the kind of soil, its stability, and some of the soil's chemical properties.

The following materials were discussed, each of which has special advantage: (1) Clay drain tiles; (2) porous concrete drain tiles; (3) pipes of Portland cement; (4) no-joint concrete pipe; (5) concrete-pipes with bituminous coat; (6) impregnated concrete pipes; (7) special cement pipes; (8) steel pipes with or without protection; and (9) other materials such as plastic, "Eternit," wood drains with rectangular cross-sections, etc.

4362. Reigner, I. C. A VINYL-LINED WEIR FOR SMALL-WATERSHED STUDIES. J. Forestry 61: 297-298. 1963. 99.8 F768

An inexpensive weir to gage small streams was built of wood and lined with a sheet of vinyl film. The cost was about $850 and the weir is expected to last 5 to 10 years without repair. Construction details were presented.

4363. Riek, H. W. RUBBER TUBE SOLVES SEEPAGE PROBLEM IN IRRIGATION DITCH. Soil Conserv. 29 (11): 246. 1964. 1.6 So35

A report was given on the use of a 4 feet in diameter and 875 feet long tube made with butyl rubber with nylon fabric reinforcement to carry irrigation water without seepage on a steep unstable hillside.

4364. Riga. Latviiskii Nauchno-Issledovatel'skii Institut Gidrotekhniki i Melioratsii. INVESTIGATIONS ON PROBLEMS OF CONSTRUCTION AND UTILIZATION OF DRAINAGE SYSTEMS. (Rus) Riga, Akademila Nauk Latviiskoi SSR, 106 pp. 1957. 54 R44

4365. Rochlitzer, J., Olbertz, M. H., and Holjewilken, H. PROBLEMS OF WATER ECONOMY AND RECLAMATION. (Ge) Deut. Akad. der Landwirtwiss. Sitzber. 11(4), 50 pp. 1962. 18 D4825 English summary

Drainage machinery, used in Germany, was described and illustrated.

4366. Rodionov, G. V. A NEW METHOD OF LAND EXCAVATION IN CANAL BUILDING. (Rus) Gidrotekh. i Melior 7(9): 33-38. Sept. 1955. 290.8 G362

4367. Roger, G. USE OF MACHINERY FOR THE CONSTRUCTION AND MAINTENANCE OF THE DRAINAGE SYSTEMS IN THE MARSHLANDS OF THE CHARENTE MARITIME. (Fr) Internatl. Cong. Agr. Engin. Trans. 5 (1): 570-585. 1958, pub. 1960. 290.9 C765C
English summary.

The use of machinery for the construction and maintenance of drainage canals and ditches in the marshlands of Charente Maritime in France was described and illustrated. General information on these marshlands was also given.

4368. Rollins, M. B., Hallam, M. J., and Myers, V. I. THE APPARENT SWELLING BEHAVIOR OF SOME MODERATELY DISPERSED BENTONITES. Soil Sci. Soc. Amer. Proc. 25(5): 407-409. Sept./Oct. 1961. 56.9 So3

A study was conducted to measure the swelling rate of various dispersed bentonites. The role of continued swelling of clay micelles in the sealing of conveyance channels with seepage-transported bentonite was characterized.

4369. Ronai, F. PREFABRICATED WATER DRAINAGE SYSTEM FOR FORESTS ROADS. (Hu) Erdo 9(5): 165-170. May 1960. 99.8 Er22

4370. Roquero De Laburu, C. CONSTRUCTION OF TERRACES WITH SIMPLE TOOLS. (Sp) Spain Min. de Agr. P. de Capacitacion Agr. Hojas Divulg. 16-56 H, 20 pp. Aug. 1956. 15 H68

4371. Roschanowski, D. J. DRAINAGE MACHINE SYSTEM FOR HEAVIER MELIORATION WORK. (Ge) Deut. Agrartech. 14(1): 9-10. Jan. 1964. 58.8 D482

4372. Saakov, A. V. IRRIGATION AND DRAINAGE CONSTRUCTION IN THE SHIRVAN STEPPE. (Rus) Gidrotekh. i Melior. 1960(3): 3-10, map. Mar. 1960. 290.8 G362

4373. Salas, A. H. RESULTS OBTAINED WITH A SMALL DITCH DIGGING MACHINE AND ITS POSSIBLE USE FOR FOREST PLANTINGS ON THE ISLANDS OF THE PARANA DELTA. (Sp) Forest Argentina 4(4): 129-132. Oct./Dec. 1960. 99.8 R3252

4374. Salmgren, O. DRAINAGE PLOWS IN FINNISH FORESTS DRAINED ONE MILLION HECTARE. (Sw) Jord och Skog 13(7): 345-347, 365. 1961. 58.8 M373

4375. Schie, J. J. Van. EXPERIENCES WITH MECHANICAL CONSTRUCTION OF DRAINAGE. (Du) Groenten en Fruit 19(45): 1961. May 13, 1964. 80 G89

4376. Schirmer, M. NEW DRAIN OUTLET PIECES FROM STONEWARE. (Ge) Wasser u. Boden 10(10): 329-330. Oct. 1958. 56.8 W28

4377. Schlunsen, D. MECHANIZATION OF DRAINAGE WORK. (Ge) Lohnunternehmen in Land- u. Forstwirt. 19(1): 2-4, 6. Jan. 15, 1964. 58.8 D81

4378. Schlunsen, H. DRAINAGE WITH MACHINES. (Ge) Mitt. der Deut. Landwirt.-Gesell. 79(50): 1687-1689. Dec. 10, 1964. 18 N39

4379. Schmidt. CONSTRUCTION AND CLEANING EQUIPMENT FOR WATERCOURSES. (Ge) Kuratorium f. Kultbauw. Jahresversamml. 1959: 27-32. 1959. 290.9 K96

4380. Schmidt, H. DEVELOPMENT OF EQUIPMENT FOR CONSTRUCTING AND CLEARING WATER-COURSES. (Ge) Schrreihe. des Kuratoriums f. Kultbauw. 6, 97 pp. 1957. 18 Sch 73

4381. Schmidt, H. THE DEVELOPMENT OF EQUIPMENT FOR THE CONSTRUCTION AND CLEARING OF WATER COURSES. (Ge) Schrreihe. des Kuratoriums f. Kultbauw. 13, 145 pp. Ref. 1964. 18 Sch73

4382. Scholberg, P. PITCH FIBRE PIPE FOR FARM USE. Farm Bldg. Assoc. J. 4: 83. Dec. 1960. 296.9 F22

A report was given on the use and installation of pitch fiber pipe for sewage pipes and perforated pitch fiber pipes for land drainage in England.

4383. Schwab, G. O., Everett, R. K., and DeVries, L. L. TILE-TRENCHING MACHINE PERFORMANCE. Agr. Engin. 37(7): 469-472. July 1956. 58.8 Ag83

Data on performance and operating costs of tile-trenching machines, gathered over a 4-year period, provide valuable aids in evaluating the economics of machine tiling.

4384. Schwab, G. O., Frevert, R. K., and DeVries, L. L. TILING TRENCHES: PERFORMANCE, COST. Land Impr. 3(12): 12-14. Dec. 1956. 282.8 L224

A report was given on the cost and performance of tiling trenches. The data were obtained during a 4-year period (1947-51) from a series of field observations of wheel and endless-chain trenching machines and from questionnaires sent to contractors. Light-weight machines mounted on tractors or wheeled vehicles were not included.

4385. Scott, D. F. USE OF SPINNER SURFACE-DRAIN DIGGER IN AUCKLAND PROVINCE. New Zeal. J. Agr. 102(4): 317-318. Apr. 15, 1961. 23 N48J

A report was given on the construction and use of a spinner surface-drain digger used in New Zealand for the digging and cleaning of surface drain canals.

4386. Scott, J. F. DITCHING WITH EXPLOSIVES. New Zeal. J. Agr. 103(1): 85, 87, 89. July 15, 1961. 23 N48J

A report was given of the use of explosives to construct drainage ditches in New Zealand where machinery is not available or where the area is too wet for heavy machines.

4387. Scott, V. H. PREFABRICATED LININGS FOR IRRIGATION DITCHES. Agr. Engin. 37: 113-116, 119. 1956. 58.8 Ag83

Prefabricated linings in small irrigation farm ditches and reservoirs are needed if good water management is to be accomplished. A prefabricated lining should be: Relatively light in weight; chemically inert; flexible; tough; resistant to impact; durable; resistant to vegetative growth; low in transmitting water; resistant to bacterial attack; easily and inexpensively maintained; and low in initial cost.

4388. Sedov, I. V. EFFECTIVE UTILIZATION OF [DRAINAGE AND LAND CLEARING] MACHINERY IN RECLAMATION OF MEADOWS AND PASTURES. (Rus) Zhivotnovodstvo 7: 84-87. July 1955. 49 Z6

4389. Sel'Skokhoziaistvennye. MELIORATSII [AGRICULTURAL IMPROVEMENT; PER MATERIAL OF THE ALL-UNION AGRICULTURAL EXHIBIT]. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel' skokhoziaistvennoi Literatury, 511 pp. 1956. (Peredovoi Opyt v Sel'skom Khoziaistve) 290 Se4

4390. Sergutin, V. E. EXPERIENCE IN ESTABLISHING DRAINAGE DITCHES ON FOREST LAND BY THE EXPLOSIVE METHOD. (Rus) Lesn. Zhur. 1962(2): 68-71. 1962. 99.8 Iz8

4391. Serikov, Y. M. MECHANIZATION OF THE CARE OF FOREST CROPS ON THE TERRACES OF MOUNTAIN SLOPES. (Rus) Lesn. Khoz. 1961(6): 55-58. June 1961. 99.8 L5622

4392. Setala, S. DIGGING CANALS. (Fi) Teho 4: 205-206. 1955. 20 T98
English summary.

The importance of canals as water outlets for smaller ditches for the basic drainage of the land in Finland was discussed. The implements used for digging the canals were described and the costs of digging the canals with the different equipment were given.

4393. Shaumyan, V. A. IRRIGATION SYSTEMS WITH DISTRIBUTIVE PIPING. (Rus) Gidrotekh. i Melior. 1961(3): 34-47. Mar. 1961. 290.8 G362

4394. Sheptitskii, B. A., and Kryukov, L. G. CONSTRUCTION OF MASS CONCRETE LINING BY MEANS OF PNEUMATIC JETTING ON IRRIGATION CANALS. (Rus) Gidrotekh. i Melior. 6: 15-23. June 1963. 290.8 G362

4395. Shtepa, B. G. SECTIONAL IRON-CONCRETE DRAINS. (Rus) Gidrotekh. i Melior. 7(7): 22-25. July 1955. 290.8 G362

4396. Shull, H. SELF-PROPELLED DRAINAGE LINE CAMERA. Agr. Engin. 44(9): 494-495. Sept. 1963. 58.8 Ag83

A self-propelled drainage line camera was described and illustrated that has shown misalignment in tile lines and roots in tile lines.

4397. Silkin, A. M. BUILDING EMBANKMENTS IN SWAMPS. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 40: 125-236. Ref. 1961. 106 P44
English summary.

A new system for the construction classification of bogs and peats was proposed for the USSR.

4398. Sine, L. NEW TECHNIQUES IN DRAINAGE. Landtechnik, 19. Jg., Heft 21/22, Mid-Nov. 1964. 58.8 L235

4399. Sisson, D. R. BETTER FARM DRAINAGE NEEDED. Crops & Soils 13(1): 12-14. Oct. 1960. 6 W55

A report was given on the experience and research for improved drainage methods in the last 10 to 20 years. The principle types of field drainage were described and new materials and equipment used for drainage were discussed.

4400. Skotnikov, V., and Petrovich, D. MACHINES FOR DRAINAGE AND RECLAMATION BOGS. (Rus) Tekh. v Sel'sk. Khoz. 2: 36-43. Feb. 1963. 58.8 M11

4401. Skov, K. S. DEMONSTRATION OF DRAINAGE EQUIPMENT IN NORTH GERMANY. (Da) Hedeselsk. Tidsskr. 84(13): 327-330. Oct. 15, 1963. 11 H35

4402. Slepoi, I. S. THE METHOD OF DETERMINING THE EFFICIENCY OF DREDGES UNDER OPERATION CONDITIONS. (Rus) Gidrotekh. i Melior. 7(7): 29-32. July 1955. 290.8 G362

4403. Smirnov, A. V. EXPERIENCE IN CONSTRUCTING CLOSED DRAINAGE IN AGRICULTURE. (Rus) Moscow. Vsesoyuzn. Nauch.-Issled. Inst. Gidrotekh. i Melior. Nauch. Trudy. 37: 52-87. 1962. 292.9 M85

4404. Smith, D. D., and Coyle, J. J. MACHINES FOR CONSERVATION. U.S. Dept. Agr., Agr. Ybk. 1960: 107-113. 1960. 1 Ag84Y

A report was given on machines for conservation. Machines were described for constructing both surface drainage and subsurface drainage.

4405. Someren, C. L. Van. THE DEVELOPMENT OF THE TECHNIQUE OF MECHANICAL DRAINAGE. (Du) Landbk. Tijdschr. 71(12): 354-360. June 1959. 105.2 Or3

4406. Someren, Van. DRAINAGE WITH PLASTIC TUBES IN THE LOW COUNTRIES. (Fr) Pepinieristes Hort. Maraichers 47: 2052-2054. May 1964. 80 P39

4407. Sondern, J. A. PLASTIC DRAINAGE PIPES FOR INFILTRATION IN GREENHOUSES. (Du) Groenten en Fruit 17(19): 673, 675. Nov. 16, 1961. 80 G89

4408. Sondern, J. A. SUB-IRRIGATION BY MEANS OF PLASTIC PIPES IN HOTHOUSES FOR THE GROWING OF TOMATOES. Internatl. Hort. Cong. Proc. 16(5): 726-727. 1962, pub. 1964. 90.09 C7616P

A report was given on the use of plastic pipes for subirrigation and subsurface drainage in the greenhouse.

4409. Spencer, G. W., and Carder, D. J. BUILD CONTOUR BANKS WITH A DISC PLOUGH. West. Austral. Dept. Agr. J. (ser. 4) 5(5): 278-280, 283-285. May 1964. 23 W52J

A report was given on the farm construction of contour banks (terraces) in Australia by a disk plow.

4410. Spencer, G. W., and Grasby, J. C. BUILD CONTOUR BANKS WITH A DISC PLOUGH. West. Austral. Dept. Agr. J. (ser. 3) 5: 201-204. Mar./Apr. 1956. 23W52J

A report was given on the construction of contour banks (terraces) by disk plows in western Australia.

4411. Staff, C. E. PLASTIC FILMS IN WATER CONSERVATION. Nat. Agr. Plast. Conf. Proc. 4: 132-136. 1963. 309.9 N216

A report was given on the use of plastic films in water conservation in the United States. The use of plastic film for rice levees and for seepage control on dams, canals, and reservoirs was included in the discussion.

4412. Stefanov, I. A., and Gusev, D. M. FLOOD PIPING MADE FROM ASBESTOS-CEMENT SHEATING. (Rus) Gidrotekh. i Melior. 7(10): 29-38. Oct. 1955. 290.8 G362

4413. Steffanoni, L. LEVELLING OF LAND. (It) Riso 4(12): 16-18. Dec. 1955. 59.8 R49 English summary.

A report was given on the machinery used in Italy for land levelling for irrigation and drainage.

4414. Stoeckeler, J. H. ANGLE DOZER USED FOR TREE PLANTING. J. Soil and Water Conserv. 17: 178-179. 1962. 56.8 J822

A 6-foot-wide, adjustable angle dozer blade mounted on a light crawler tractor was used to make a series of level bench terraces on the contour. These terraces, 16 to 20 inches wide, were subsequently hand planted to a variety of tree species of different age classes. A total of 30.5 miles of bench terrace was constructed.

4415. Story, C. G., and Toohey, C. L. LAND DRAINAGE DEMONSTRATED AT COCKY POINT. Queensland Bur. Sugar Expt. Sta. Cane Growers' Q. B. 28(2): 44-46. Oct. 1, 1964. 65.9 Q3C

A report was given of a land drainage demonstration in Australia for sugarcane production.

4416. Streeter, V. L. A FLOW CONTROLLER FOR OPEN OR CLOSED CONDUITS. Amer. Soc. Civil Engin. Trans. 123: 883-907. 1958. 290.9 Am3

A general principle of flow control, utilizing a nonlinear resistance, was developed that is applicable to both open and closed conduits. The controller is infinitely adjustable over its design range and holds the flow close to the predetermined discharge for its head range. It is readily converted into a flow meter with a linear head-discharge curve and adjustable range and sensitivity. Experimental work was presented to confirm the theory.

4417. Swift, A. LAYING OF PIPE DITCH. (No) Landbrdept. Opplysningstjenesten. Smaskr. 8, 10 pp. 1960. 464.4 N83

4418. Swift, A. DRAINAGE PIPES OF PLASTIC. (No) Norsk Landbr. 24: 14. Nov. 22, 1963. 11 N8122

4419. Szabon, J. POSSIBILITIES FOR PLASTIC PIPE IRRIGATION. (Hu) Magyar Mezogazdasag 19(12): 12-13. Mar. 18, 1964. 19 M27

4420. Tanis, K. THE RESULTS OF MECHANICAL RECLAMATION IN THE OLD FEN COLONIES. (Du) Nederland. Heidemaatsch. Tijdschr. 72(3): 62-69. Mar. 1961. 12 N282

4421. Tanis, K. MODERN MECHANICAL SOIL IMPROVEMENT. (Du) Nederland. Heidemaatsch. Tijdschr. 74(2): 46-60. Feb. 1963. 12 N282

4422. Teipel, R. PRESENT STATUS OF MELIORATION TECHNIQUE IN THE GERMAN DEMOCRATIC REPUBLIC. (Ge) Deut. Agrartech. 7(6): 261-262. June 1957. 58.8 D482

4423. Teipel, R. MECHANIZATION OF DRAINAGE OPERATIONS. (Ge) Z. f. Landeskult. 4(2): 151-186. Ref. 1963. 282.9 Z3
English summary.

The different types of machinery used in Germany for drainage were described and illustrated.

4424. Teseling, H. J. IMPROVEMENTS IN MACHINES AND METHODS IN RECLAMATION. (Du) Nederland. Heidemaatsch. Tijdschr. 71(3): 90-93. Mar. 1960. 12 N282

4425. Thames, J. L. HYDRAULIC INSERTER FOR SOIL-MOISTURE UNITS. Soil Sci. 86(3): 156-159. Sept. 1958. 56.8 So3

A hydraulic inserter for fiberglass soil-moisture units in the sidewalls of auger holes that insures proper and efficient installation under almost any soil-site condition was described and illustrated.

4426. Tolchkov, S. M. POROUS POLYMER-CONCRETE DRAINAGE PIPES. (Rus) Gidrotekh. i Melior. 1962(2): 10-13. Feb. 1962. 290.8 G362

4427. Topchiev, E. A., and Protsenko, A. K. MACHINE FOR CUTTING IRRIGATION CANALS. (Rus) Khlopkovodstvo 2: 40-43. Feb. 1964. 72.8 K522

4428. Tsekhanovich, P. V. MECHANIZATION OF LAYING OUT MOLE DRAINS. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, p. 457-460. Minsk, 1956. 54.9 K83

4429. Tucker, D. E. FARM DRAINAGE IN PRINCIPLE AND PRACTICE. Farm Bldg. Assoc. J. 7: 57-60. Dec. 1963. 296.9 F22

A report was given on the equipment needed to handle farmstead drainage problems in England.

4430. Turetskii, R. A SYSTEM OF MACHINES FOR DRAINING AND DEVELOPING SWAMPS. (Rus) Tekh. v Sel'sk. Khoz. 1960(1): 17-21. Jan. 1960. 58.8 M11

4431. Turetskii, R. L. SYSTEM OF MACHINES FOR DRAINAGE AND RECLAMATION OF MARSHY LANDS. (Rus) Vest. Sel'skokhoz. Nauki 1961(3): 112-116. Mar. 1961. 20 V633

4432. Turetskii, R. L. A SYSTEM OF MACHINES FOR THE COMPLEX MECHANIZATION OF RECLAMATION OPERATIONS. (Rus) Mekh. i Elektrif. Sotsialist. Sel'sk. Khoz. 6: 8-10. 1962. 58.8 M46

4433. Uotila, P. J. EQUIPMENT FOR PLANNING DITCH EDGES. (Fi) Teho 8/9: 437-439. 1956. 20 T98
English summary, p. 466

Different attachments for plowing ditch edges, that are used in Finland, were described and illustrated.

4434. Uspenskii, V. P., Karev, N. V., Dimitreievskii, N. V., and Sergeev, A. I., and others. AUTOMATION OF THE DIGGING OF DRAINAGE TRENCHES WITH A GIVEN BED INCLINATION. (Rus) Gidrotekh. i Melior. 1962(3): 33-45. Mar. 1962. 290.8 G362

4435. Vagin, A. T. SOME PROBLEMS OF THE MECHANIZATION OF MARSH RECLAMATION. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV. 1955. Trudy, pp. 413-417. Minsk, 1956. 54.9 K83

4436. Vana, J. SOIL IMPROVEMENT MACHINERY IN CZECHOSLOVAKIA. U. S. Joint P. Res. Serv. Transl. East European Agr. Forestry & Food Indus. 199: 10-16. Sept. 23, 1963. 173 J663Ste
Translation from Mezinarodni Zemedelsky Casopis 7(3): 78-81. 1963.

A report was given on drainage machinery used in Czechoslovakia.

4437. Vania, J. MELIORATIVE MACHINES OF CZECHOSLOVAKIA. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 3: 89-92. 1963. 20 M57

4438. Van Straaten, N. J. BUILD YOUR OWN CONTOUR BANKS. Farming So. Africa 39 (7): 44-45, 47. Oct. 1963. 24 So842

An illustrated guide was given for the construction of contour banks (terraces) in South Africa.

4439. van't Woudt, B. D. CONCRETE PIPE FOR IRRIGATION IN HAWAII. Hawaii Agr. Expt. Sta. C. 57, 62 pp. 1959. 100 H313

A report was given on the use of concrete pipe for irrigation in Hawaii.

4440. Varday, Gy. USE OF PLASTIC PIPES IN SURFACE IRRIGATION. (Hu) Magyar Mezogazdasag 19 (31): 12-13. July 29, 1964. 19 M27

4441. Vatnebryhn, A. DRAINAGE PIPES MUST BE UNDER STRICTER CONTROL. (No) Norsk Landbr. 10: 340-341. May 12, 1961. 11 N8122

4442. Vethe, K. DITCHING OF MARSHES WITH THE VIKEIDE PLOW. (No) Norske Myrselsk. Meddel. 57(6): 206-208. Dec. 1959. 11 N813

4443. Vidal, H. NEW METHODS OF PLASTIC PIPE DRAINAGE. (Ge) Bayer. Landwirt. Jahrb. 38(2): 238-245. 1961. 18 L24

4444. Voinis, N. METHOD FOR BUILDING SMALL TERRACES BY USE OF COMMON PLOUGH IN COMBINATION WITH HOME-MADE WOODEN V DRAG. (Gre) Greece. Hyzourgeion Georgia. Deltion Gerogikon Epharmogon Ekpaideuseos 5: 136-140. Sept./Oct. 1963. 275.249 G81

4445. Voltz, C. W. WHICH KIND OF PIPE? 5. STEEL-CEMENT. Golf Course Rptr. 32(6): 48. June 1964. 60.18 G83

A report was given on the use and installation of steel-cement pipe for irrigation systems for turf.

4446. Wagner, V. J. LAYING TILE DRAINS. Queensland Agr. J. 88(5): 261-263. May 1962. 23 Q33

A report was given on the design and construction for laying clay tile drains in Australia.

4447. Wagoner, H. E. CONCRETE PIPELINE IRRIGATION AT PIONEER MILL COMPANY, LTD. Hawaii. Sugar Technol. Rpt. 19: 180-182. 1960, pub. 1961. 65.9 H317

A report was given on the use of concrete pipelines for the irrigation of sugarcane fields in Hawaii.

4448. Walter, R. J. WHICH KIND OF PIPE? 4. P.V.C. [POLYVINYL CHLORIDE]. Golf Course Rptr. 32(6): 42, 44, 46. June 1964. 60.18 G83

A report was given on the use and installation of P.V.C. (Polyvinyl chloride) plastic pipe for irrigation systems for turf.

4449. Werminghausen, B. POSSIBILITIES OF PLASTIC PIPES IN AGRICULTURE. (Ge) Mitt. der Deut. Landwirt.-Gesell. 78(46): 1470, 1472. Nov. 14, 1963. 18 N39

4450. Werminghausen, B. CAN THE FIELD IRRIGATION WITH THE HELP OF PLASTIC TUBES AND HOSES BE MADE EASIER? (Ge) Tech. u. Landwirt. 16(1): 5-7. Jan. 10, 1964. 58.8 T223

4451. Wesseling, J. THE USE OF PLASTICS IN DRAINAGE. (Du) Landbk. Tijdschr. 73(9): 355-365. Ref. May 1961. 105.2 Or3
English summary.

A report was given on the use of plastic drain tubes in the Netherlands and other European countries. A description was given of the laying of the plastic drain tiles by means of a mole plow and a trench digger.

4452. Whitaker, G. H. MECHANIZING THE SHOVEL. Queensland. Bur. Sugar Expt. Sta. Cane Growers' Q. B. 27(1): 7. July 1, 1963. 65.9 Q3C

A report was given on maintaining open field drains in Australia by a digger mounted on a tractor.

4453. White, H. C. UNDERGROUND IRRIGATION PIPE BECOMING POPULAR IN ARKANSAS. Rice J. 64(9): 26-27. Aug. 1961. 59.8 R36

A report was given on the use of asbestos-cement and concrete pipe for carrying irrigation water in Arkansas. If levelling is needed for surface drainage, it should be levelled before the pipe is installed.

4454. Wiebe, J. USE OF PLASTIC TUBING FOR TRANSPORTING IRRIGATION WATER. Natl. Hort. Plastics Conf. Proc. 3: 28. 1962. 309.9 N216

A discussion was given on the use of plastic tubing for transporting irrigation water. There is a very marked decrease in the strength of the polyethylene tubing with increasing temperature.

4455. Wilder, C. R. UNDERGROUND PIPE LINES FOR IRRIGATION AND DRAINAGE. Trans. ASAE 3(1): 65, 67. 1960. 290.9 Am32T

A report was given on the use of underground cement pipe to carry irrigation or drainage water. This pipe has the following advantage in addition to the good points for lined ditches: (1) Evaporation is eliminated; weeds and insects are practically eliminated; cultivation can be carried on over the pipe line right-of-way; and pipe lines can operate under pressure.

4456. Wilder, C. R. LOWER-COST CANAL LININGS THROUGH MECHANIZATION. Civil Engin. 31(6): 39-41. 1961. 280.9 C49

About 25 percent of the water entering an irrigation system of unlined canals never reaches the farm. Losses in some unlined canals are much greater, and many large supply canals approach or exceed the classical loss of "1 percent per mile." Lining can conserve much of this water. Through mechanization, the cost of canal lining has been held reasonably constant since 1945, despite doubling of construction costs in general. New machines and improved controls have contributed greatly to this result.

4457. Wilder, C. R. USES OF CEMENT IN WATER MANAGEMENT. Ariz. Watershed Symp. Annu. Proc. Symp. 5: 16-20. 1961. 292.9 Ar425

A report was given on the use of cement for various types of water management in the United States. The use in irrigation and drainage ditches and canals was included.

4458. Wishart, R. L. NEW DRAINAGE TECHNIQUES CUT COSTS. So. Austral. Dept. Agr. J. 67(6): 202-206. Jan. 1964. 23 So84

A report was given on the economics of plastic tile and new machines to cut narrow trenches for tile drainage on riverflat areas in South Australia.

4459. Witherspoon, D. F., and Hore, F. R. DESIGN OF A PROPORTIONAL WEIR FOR USE IN A FLOW-METER. Agr. Engin. 38(12): 867. Dec. 1957. 58.8 Ag83

A Rettger proportional flow weir was described and illustrated that has been satisfactorily used in the field for accurate measurements of small amounts of drain effluent.

4460. Yakubovich, L. V. USE OF PLASTICS IN IRRIGATION AND DRAINAGE. (Rus) Zemledelie 3: 86-92. Mar. 1964. 20 Z44

4461. Yasinetskii, V. G. TECHNOLOGY OF GROUND WORK DURING CONSTRUCTION OF IRRIGATION CANALS USING NEW FLOW-TYPE MACHINERY. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 50: 159-167. 1963. 106 P44
English summary.

4462. Yuan, S. C., and Ku, P. C. SHANSI PROVINCE MAKES MAXIMUM USE OF EXISTING DRAINING AND IRRIGATION EQUIPMENT. U. S. Joint P. Res. Serv. Transl. Communist China's Agr. Anim. Husb. & Mater. 38: 63-65. Apr. 9, 1963. 173 J663Trc
Translation from Kung-jen Jih-pao, Feb. 3, 1963: 1. 1963.

A report was given on the maintenance and use of drainage and irrigation machinery and in Shansi Province in China.

4463. Zanna, L. EQUIPMENT OF SOIL REGULATION. (It) Genio Rur. 27(9): 809-819. Sept. 1964. 281.8 R522

4464. Zdravkov, K. MECHANIZATION OF TERRACE MAKING AND SOIL TILLAGE ON SLOPES. (Bu) Mashinizirano Zemedel. 8(9): 13-16. Sept. 1957. 58.8 M374

4465. Zeldam, O. T., and Reschke, K. DRAINAGE WITH PLASTIC PIPES. (Ge) Wasser u. Boden 13 (10): 363-366. Oct. 1961. 56.8 W28

4466. Zherebstov, V. V. NEW DIGGING MACHINES. (Rus) Khlopkovodstvo 5: 40-41. May 1963. 72.8 K522

4467. Ziegenbalg, F. AUTOMATIC CONTROL AND REGULATION OF MELIORATION MACHINES. (Ge) Deut. Agrartech. 14(1): 15-17. Jan. 1964. 58.8 D482

4468. Ziulikov, G. M. SECTIONAL IRON-CONCRETE FITTINGS OF ASBESTOS CEMENT PIPES. (Rus) Gidrotekh. i Melior. 9(1): 38-44. Jan. 1957. 290.8 G362

SEE ALSO--36, 45, 46, 86, 127, 145, 147, 382, 414, 454, 509, 554, 701, 729, 821, 861, 864, 875, 964, 1013, 1026, 1136, 1154, 1176, 1202, 1342, 1419, 1514, 1527, 1529, 1532, 1548, 1567, 1568, 1575, 1636-1638, 1641, 1677, 1679, 1682, 1693, 1699, 1719, 1734, 1741, 1758, 1766, 1776, 1781, 1788B, 1813-1815, 1848, 1868, 1881, 1900, 1913, 1922, 1981, 1984, 1987, 1990, 2019, 2039, 2070, 2088, 2097, 2116, 2129, 2135, 2142, 2157, 2158, 2183, 2194, 2200, 2201, 2217, 2222, 2227, 2249, 2254, 2258, 2265, 2271, 2285, 2303, 2307, 2325, 2327, 2373-2375, 2387, 2409, 2435, 2437, 2438, 2596, 2633, 2644, 2708, 2773, 2785, 2795, 2800, 2806, 2837, 2930, 2932, 2968, 2972, 2995, 3011, 3013, 3041, 3042, 3045, 3048, 3060, 3069, 3072, 3090, 3103, 3109, 3113, 3115, 3125, 3148, 3150, 3157, 3166, 3173, 3188, 3194, 3196, 3200, 3206, 3209, 3227, 3235, 3236, 3242, 3244, 3250, 3258, 3260, 3261, 3268, 3269, 3276, 3278, 3280, 3281, 3284-3286, 3290, 3291, 3297, 3298, 3301, 3303, 3305, 3309-3315, 3319, 3322, 3324-3329, 3337, 3342-3347, 3357, 3368, 3379, 3381, 3382, 3384, 3385, 3387, 3392, 3394-3397, 3399, 3401, 3402, 3416, 3419-3422, 3426, 3429, 3431, 3438, 3444, 3447-3449, 3451, 3460-3462, 3463, 3471, 3473, 3474, 3476, 3477, 3485, 3486, 3489, 3490, 3492, 3494, 3497, 3517, 3545, 3558, 3563, 3571, 3591, 3612, 3617, 3637, 3652, 3654, 3661, 3664, 3666, 3675, 3676, 3681, 3701, 3713, 3728, 3731, 3733, 3742, 3743, 3745, 3746, 3752, 3758, 3763, 3764, 3770, 3791, 3834, 3839, 3858, 3860, 3877, 3879, 3882, 3898-3900, 3916, 3929, 3940, 3955, 3963, 3966, 3977, 3982, 4000, 4007-4009, 4031, 4042, 4044, 4062, 4069, 4077, 4470, 4471, 4475, 4476, 4479, 4482, 4489, 4494, 4495, 4498-4502, 4505, 4506, 4508, 4509, 4511, 4513-4517, 4520-4525, 4528-4530, 4532, 4534-4546, 4548, 4549, 4551, 4554-4556, 4558-4565, 4570, 4572-4576, 4581, 4582, 4588-4592, 4598, 4601, 4603-4606, 4608, 4611-4617, 4623, 4625, 4629, 4631-4649, 4651, 4652, 4656, 4657, 4660, 4662, 4667-4669, 4671, 4675-4680, 4682, 4685-4688, 4694, 4699-4701, 4703-4705, 4708-4710, 4713, 4714, 4716-4720, 4725, 4727-4733, 4735-4740, 4743-4747, 4749-4751, 4753, 4755, 4757, 4759, 4762, 4764, 4765, 4767, 4770, 4776-4778, 4780-4782, 4786-4788, 4791, 4792, 4795, 4797-4807, 4809-4812, 4814, 4817, 4818, 4820, 4854, 4965, 4971, 4973, 4997, 5003, 5007, 5020, 5022, 5026, 5114, 5115.

Maintenance

4469. Ahlf, H. FARMLAND IN THE SHELTER OF DIKES. (Ge) Ubersicht 13(11): 530-532. Nov. 10, 1962. 18 Ub3

4470. Ahmed, N., Ahmed, M., and Shah, S. L. PROBLEMS OF CANAL LINING IN WEST PAKISTAN. Cong. Irrig. & Drainage Trans. 3(2): 7.17-7.48, map. Ref. 1957. 55.9 C7652

A report was given of the problems of canal linings in West Pakistan where construction labor is cheaper than materials and machines. The problems of seepage and failure of double tile linings were discussed along with a suggestion for a new design of double tile linings.

4471. Aidarov, I. P., and Brusentsev, V. F. ANTI-FILTRATING BENTONITE LININGS FOR IRRIGATION CANALS OF GOLODNAYA STEP. (Rus) Timiryazevskaya Sel'skokhoz. Akad. Izv. 46: 160-170. 1962. 106 P44
English summary.

A report was given on the use of anti-filtrating bentonite linings for irrigation canals in the U.S.S.R.

4472. Alekand, K. MAKING THE FILL FOR DRAINAGE TRENCHES MORE COMPACT. (Es) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov 22: 3-7. 1961. 106 Es83
German summary.

4473. Aliev, I. G. CONTROL OF WATER LOSSES FROM THE TEMPORARY IRRIGATION SYSTEM. (Rus) In Azerbaijan Ministerstvo Sel'skogo Khoziaistva. SBORNIK MATERIALOV PO KHLOPKOVODSTVU. Baku, Azerbaidzhanskoe Gosudarstvennoe Izdatel'stvo, pp. 37-50. 1956. 72 Az2

4474. Anonymous. LINING OF CANALS IN JAPAN. Cong. Irrig. & Drainage Trans. 3(2): 7.205-7.226. 1957. 55.9 C7652

A report was given on the various types of linings used in canals in Japan. The use of concrete linings with many shapes of concrete blocks was stressed. These linings have proved to: Resist erosion of running water; save considerably on concrete materials; and make construction quite easy.

4475. Anonymous. SEALING EARTH DAMS. Rur. Res. C.S.I.R.O. 32: 10-11. June 1960. 23 R88

A report was given on the use of bentonite for sealing reservoirs for seepage control in New South Wales, Australia.

4476. Antonescu, I. P., Goldstein, M., and Ionescu, I. THE EXPERIMENT OF SOME WATERPROOF COATINGS AND WATERPROOFING METHODS FOR IRRIGATION CHANNELS BUILT ON LOESS. (Rum) Studii de Goeteh. Fundatii si Constr. Hidroteh. 6: 143-183. Ref. 1963. 290.8 St92
French, German, and Russian summaries.

4477. Apmann, R. P. RESEARCH SEEKS BEST TECHNIQUES FOR STABILIZING STREAM CHANNELS. Soil Conserv. 29(9): 199-201. 1964. 1.6 So3S

A report was given on the research being conducted on stabilizing stream channels. The use of revetment blocks for the Buffalo Creek Watershed in New York was discussed.

4478. Austin, W. G. L. CONTROL OF AQUATIC WEEDS. Outlook Agr. 4(1): 35-43. 1963. 10 Ou8

Recommended control methods for aquatic weeds were given for irrigation and drainage canals, ponds, and lakes. The author concluded that chemicals are now available that will control most of the important species of aquatic weeds. All these compounds, however, have limitations: the perfect aquatic herbicide has yet to be discovered. Chemicals will play an increasingly important part in aquatic weed control. Progress will inevitably be slow because of: (1) The sheer difficulty of evaluating weed-killers in an aquatic environment; (2) the need for careful investigation of possible side effects; and (3) the new problems which the use of chemicals may create in some cases.

4479. Bagramian, G. A. ON LININGS FOR IRRIGATION CANALS. (Rus) Gidrotekh. i Melior. 10(8): 3-7. Aug. 1958. 290.8 G362

4480. Banfield, G. L. WEED CONTROL IN DRAINS. New Zeal. Weed Control Conf. Proc. 8: 77-80. 1955. 79.9 N213

Chemical, manual, and mechanical methods of controlling weeds in open drains in New Zealand were given. Of the materials studied, the chlorates and urea compounds were well qualified to supersede orthodox methods of drain cleaning. The arsenicals, which were the cheapest, had a place under special circumstances.

4481. Banfield, G. L. NEW ASPECTS OF CHEMICAL CONTROL OF WEEDS IN DRAINS. New Zeal. Weed Control Conf. Proc. 12: 73-76. 1959. 79.9 N213

A report was given on the experimental results of use of chemical weed control to supplement mechanical weed control in drains in New Zealand.

4482. Barona de la O, I. F. CONCRETE LINING OF IRRIGATION CANALS IN MEXICO. Cong. Irrig. & Drain. Trans. 3(2): 7.177-7.190. 1957. 55.9 C7652

The need and use were given for concrete linings of irrigation canals in Mexico.

4483. Beauchamp, K. H. HOW TO KEEP 'EM DRAINING. Land Impr. 5(4): 13-15. Apr. 1958. 282.8 L224

The maintenance of tile drains and outlet ditches were discussed.

4484. Berglund, G. RENOVATION OF OLD DRAINAGE DITCHES. (Sw) Lantmannen 75(25): 640-641. June 20, 1964. 11 L234

4485. Bernhardt, R. THE COSTS OF SEA DIKES. (Ge) Recht der Landwirt. 13(7): 172-175. July 1961. 30.58 R24

4486. Bessa, J. INTEREST IN AND USE OF HERBICIDES BY THE NATIONAL DEPARTMENT OF SANITATION WORK, IN THE DISTRICT SANTA CATARINA. (Por) Seminario Bras. de Herbicidas e Ervas Daninhas. An. 2: 155-159. 1958, pub. 1959. 79.9 Se5A

4487. Birkaia, A. F., and Gudzhabidze, N. I. APPLICATION OF HERBICIDES TO CONTROL WEEDS IN DRAINAGE CANALS IN COLCHIS. (Rus) Gidrotekh. i Melior. 9(4): 41-48. Apr. 1957. 290.8 G362

4488. Blackburn, R. D. EVALUATING HERBICIDES AGAINST AQUATIC WEEDS. Weeds 11: 21-24. 1963. 79.8 W41

Techniques were developed for evaluating herbicides on submersed, floating, and emersed aquatic weeds. Among 75 herbicides evaluated on three species of submersed weeds only diquat, paraquat, endothal, and acrolein gave 85 percent or better control at 1 p.p.m.w. in still-water tests. Only acrolein and the di-N, N-dimethylcocoamine salt of endothal were effective on submersed weeds at 1 p.p.m.w. in the limited-exposure test. The evaluation of 17 herbicides on three species of floating aquatic weeds indicated that diquat was effective when applied at rates of 1 or 2 lb./A. The tertiary fatty acid amines of 2,4-D were more effective on floating weeds than an ester of 2,4-D. Many of the 78 herbicides evaluated on alligator-weed (Alternanthera philoxeroides (Mart.) Griseb.) killed the tops, but only two retarded the sprouting of underwater nodes longer than 6 weeks. Applications of 20 lb./A. of silvex in two formulations retarded sprouting of underwater nodes for 8 weeks.

4489. Blackburn, W. C. A REVIEW OF THE USE OF CHEMICAL SEALANTS FOR REDUCTION OF CANAL SEEPAGE LOSSES: LOWER-COST CANAL LINING PROGRAM. Bur. Reclam. Analy. Lab. Rpt. CH-102, 17 pp. 1960.

The chemical soil sealants are materials which are applied to the canal subgrade where they react chemically to form solid or semisolid gels, deposit precipitates in the soil voids, or otherwise render the subgrade impervious to water. Various methods of application may be used such as surface spraying, subsurface injection, or addition of the chemicals to the canal water, the method selected depending upon the type of sealant used, and the environmental conditions existing at the application site.

This report: (1) Presents a brief historical review of typical investigative work performed in the field of chemical soil sealants; (2) discusses some of the types of chemical available and possible methods of application; (3) recommends future investigative work; and (4) provides a selected bibliography of literature pertaining to this subject.

4490. Blair, G. Y. LAND SUBSIDENCE COMPLICATES IRRIGATION. J. Soil & Water Conserv. 16(5): 234-235. Sept./Oct. 1961. 56.8 J822

A report was given of the Firebaugh Canal Company in Fresno, California. Topographical maps indicated that land subsidence of 3 to 8 feet had occurred from 1925-56. After a thorough study, it was decided to install additional lift stations in the canals for the company to continue irrigation.

4491. Blanco de Cordovat, I. S. D. C. CANAL LININGS. Cong. Irrig. & Drain. Trans. 3(2): 7.285-7.339. 1957. 55.9 C7652

An illustrated report was given on the use and construction of canal linings in Spain.

4492. Blaney, H. F. CONSUMPTIVE USE AND WATER WASTE BY PHREATOPHYTES. J. Irrig. and Drain. Div. ASCE 87 (IR 3): 37-46. Sept. 1961. 290.9 Am3PS

Phreatophytes are vigorous, water-loving plants ranging from small natural vegetation to large saltcedar (tamarisk) and cottonwood trees. These plants habitually obtain their water supply from the zone of saturation, either directly or through the capillary fringe in areas of high ground water. Although phreatophytes occur in all regions of the United States, they are the greatest menace in the areas of limited water supplies in the Southwestern States, where they occupy large areas along stream and river channels, on flood plains, and in areas of high water tables.

4493. Bogliolo, A. THE MAINTENANCE OF RECLAMATION PROJECTS. (It) Bonifica Integrale 18(2): 43-44. Feb. 1964. 55.9 As72

4494. Bogomolov, V. N., Zaidman, I. D., and Kondrashenko, A. K. COATING OF DISTRIBUTING CANALS OF IRRIGATION SYSTEMS WITH CONCRETE. (Rus) Gidrotekh. i Melior. 10(7): 5-15. July 1958. 290.8 G362

4495. Boomstra, G. J. W. SECTIONAL CUTTER-DREDGER AS USED FOR IRRIGATION AND DRAINAGE PROJECTS IN IRAQ. Way Ahead 7(4): 2-5. Mar. 1959. 280.8 W362

A sectional cutter-dredger was described and illustrated for cleaning irrigation and drainage canals in Iraq.

4496. Boutcher, L. G. CLAY SEAL BEATS SEEPAGE FROM NORTH COAST DAM. Agr. Gaz. N. S. Wales 75(8): 1186-1190, 1221. Aug. 1964. 23 N472

A report was given on the use of bentonite clay in Australia to reduce seepage loss from a dam and reservoir.

4497. Bowler, D. G. FIELD DRAINAGE. New Zealand Meat Prod. 4(1): 39. Oct. 1959. 50.8 N48

A report was given on the maintenance needs of field drainage in New Zealand.

4498. Bowler, D. G. COMMON CAUSES OF DRAINAGE SYSTEM FAILURES. New Zeal. Meat Prod. 5(9): 38-39. June 1961. 50.8 N48

A report was given on the maintenance requirements for subsurface drainage in New Zealand.

4499. Boykin, F. M., Hood, W. D., and Hoy, R. E. BUTYL RUBBER AND BUTYL FABRICS AS CANAL LININGS. Irrig. Engin. & Maintenance 7(6): 13. June 1957. 55.8 Ir 722

A report was given on an experiment where butyl rubber and butyl fabrics were used as a canal lining in the Rio Grande Valley of Texas in 1956-57.

4500. Bozhanov, E. RESULTS FROM INVESTIGATIONS INTO POLYETHYLENE LINING AND JOINTS IN IN-SITU CONCRETE LININGS. (Bu) Rastenievudni Nauk. 1(10): 121-132. 1964. 64.8 R18 English summary.

A report was given on the use of polyethylene linings for seepage control in irrigation ditches with or without a covering of soil over the lining. The use of the polyethylene linings with continuous cement linings were discussed.

4501. Braithwaite, D. L. UTAH IRRIGATORS LICK WATER LOSSES. Soil Conserv. 28(9): 203. Agr. 1963. 1.6 So3S

A report was given on the use of concrete lined irrigation canals to reduce seepage losses and concrete diversions for flood control in Utah.

4502. Brusentsev, V. F., and Aidarov, I. P. APPLICATION OF BENTONITE LOAMS FOR ANTIFILTRATION SCREENS FOR FARM IRRIGATION NETWORKS IN THE GOLODNAYA STEP. (Rus) Gidrotekh. i Melior. 1959(11): 21-23. Nov. 1959. 290.8 G362

4503. Burger, K. NEW METHOD OF CHEMICAL WEED CONTROL IN IRRIGATION AND DRAINAGE CANALS. (Rus) Mezhdunarod. Sel'skokhoz. Zhur. 1961(4): 170-171. 1961. 20 M57

4504. Bylterud, A. CHEMICAL CONTROL OF WEEDS IN DITCHES AND CANALS. (No) Ny Jord 50(6): 246-250. Dec. 1963. 282.28 N98

4505. Cabanius, M.M.J., Desmoulins, G., and Muller-Feuga, R. DESCRIPTION OF THE "AUTOSTABLE" BANK SLABS USED TO FACE AN IRRIGATION CANAL, AS A MEANS OF STANDARDIZING THE CROSS SECTION TO MEET PARTICULAR CONDITIONS. Cong. Irrig. & Drain. Trans. 4(6): C.271-C.288. 1960.

A report was given on the use of pre-cast concrete slabs in France to line small irrigation canals.

4506. Canada Experimental Farms. REPORT ON DYKELAND RECLAMATION, 1913 TO 1952. Ottawa. 63 pp. 1954. 54 C162

A detailed report was given on dikeland reclamation in Canada from 1913-52.

4507. Carder, D. J., and Spencer, G. W. SOIL CONSERVATION; CONTOUR BANKS MUST BE MAINTAINED. West. Austral. Dept. Agr. J. (ser. 4)5(4): 213-214, 217-218, 221-222. Apr. 1964. 23 W52J

A report was given on the maintenance of contour banks (terraces) in Australia.

4508. Carlos, A. D. P., and Gromicho, A. P. LININGS OF IRRIGATION CANALS IN PORTUGAL. (Fr) Cong. Irrig. & Drain. Trans. 3(2): 7.49-7.66. 1957. 55.9 C7652

A report was given on the irrigation canal linings used in Portugal. The most widely used linings are those using pre-fabricated elements using cement and sand and the concrete or reinforced concrete linings.

4509. Castanon Albertos, G. PREFABRICATED CANALS AND DYKES. Cong. Irrig. & Drain. Trans. 4(6): C.365-C.386. 1960. 55.9 C7652

A report was given on the use of prefabricated irrigation canals and dikes to control seepage in Spain.

4510. Ceisler, J. DRIFTWOOD: A DRAINAGE MAINTENANCE PROBLEM. Pub. Works 92(8): 105-106. Aug. 1961. 290.8 M922

A report was given on the problem of driftwood as a drainage maintenance problem in California.

4511. Coles, L. E. PREVENTING MULTIMILLION-DOLLAR WASTE. Natl. Water Res. Symp. Proc. 1961: 190-194. 1961. 292.9 N214

A discussion was given on ways to prevent the multimillion dollar waste of water in irrigation. The use of the various types of linings for irrigation canals was discussed.

4512. Cooke, F. T., Jr. AN ECONOMIC ANALYSIS OF FACTORS AFFECTING WATER LOSS IN IRRIGATION CHANNELS IN THE YAZOO-MISSISSIPPI DELTA. Miss. Agr. Expt. Sta. B. 626, 7 pp. 1961. 100 M693

To determine if evaporation and seepage were important factors in water cost in the Mississippi Delta, water losses were measured in irrigation channels in sandy, loam, and clay soils. Due to peculiarities in these soil types, it was found that the greatest losses were in clay soils and the smallest losses were in sandy soils. Extreme cracking in the clay soils caused higher losses, while a high percentage of silt in sandy soils caused a sealing which reduced water seepage in these soils.

When the low cost of pumping water in the area was taken into consideration, transportation systems which reduced or eliminated the high water losses found in clay soils cost more on an annual basis than the value of the water lost during an irrigation season.

4513. Corry, J. A., and Scott, V. H. POLYETHYLENE FILM FOR DITCH LININGS. Irrig. Engin. and Maintenance 8(10): 12-13. 1958. 55.8 Ir722

Recent estimates and measurements indicated that from one-fourth to as high as one-half of the water conveyed in canals and ditches for irrigation was lost by seepage.

Black polyethylene film, 1 1/2, 4, and 8 mils in thickness were tested in several field installations for evaluation of seepage and vegetation control, water control, installation and handling methods, and mechanical and animal damage.

All thicknesses of film were successful in controlling Johnson, Bermuda, water grass, and most other persistent weeds and grasses. Nutgrass has proven a problem. It has penetrated 1.5 and 4-mil film. It would be best to use 8-mil film if nutgrass is present.

A serious and difficult problem to handle on some irrigated farms is ditch bank washouts. This problem is common in sandy soils and sometimes in heavier soils. Film of 1.5 and 4 and 8-mil thicknesses have effectively prevented washouts, eliminating costly and oftentimes inadequate stop gap measures. Another important advantage of polyethylene film linings is reduced bank sloughing and erosion.

4514. Cross, M. W. TRACTOR POWER HARNESSED TO MAKE DRAIN-CLEANING EASY. New Zeal. Meat Prod. 4(9): 26-27. June 1960. 50.8 N48

A report was given of the uses of tractor drawn machinery for the cleaning of open ditches in New Zealand.

4515. Cutler, W. A., and Grigsby, B. H. CONTROL OF CATTAIL AND OTHER VEGETATION IN DRAINAGE DITCHES. Trans. ASAE 3(1): 66-67. 1960. 290.9 Am32T

Test results from a 3-year experiment showed that cattails can be eradicated with dalapon. The logical treatment for woody growth was cutting and subsequent spraying of regrowth before it was more than 10 inches tall.

4516. Cutler, W. A., Wheaton, R. Z., and Kidder, E. H. DRAINAGE SYSTEM ENDURANCE IN ORGANIC SOILS. Agr. Engin. 42(2): 79-81, 85. Feb. 1961. 58.8 Ag83

A 7-year study of a tile drainage system in organic soils in Michigan was reported to provide information on durability and stability of underdrains and surface subsidence. Four types of cement tile were tested along with perforated galvanized steel pipe and perforated bituminous fiber pipe.

4517. Dadayev, G. T. SOIL STABILIZATION IN IRRIGATION CONSTRUCTION. Cong. Irrig. & Drain. Trans. 3(2): 7.345-7.368. 1957. 55.9 C7652

A report was given on the problems of constructing irrigation canals with an anti-filtration screen made of stabilized soils in the U.S.S.R. The use of special soil stabilizing machines was recommended. Data were given on improved mechanical and anti-filtration properties of soils in construction foundations.

4518. Daniels, R. B. ENTRENCHMENT OF THE WILLOW DRAINAGE DITCH, HARRISON COUNTY, IOWA. Amer. J. Sci. 258: 161-176. 1960. 470 Am34

The changes in the Willow Drainage Ditch since 1919-20 were reconstructed by comparison of the original profile of the ditch, historical records, and a survey of the ditch in 1958. Since construction, the drainage ditch has filled where the ditch was constructed on the Missouri River Valley. The drainage ditch in the Willow River Valley has entrenched, however, and becomes progressively deeper upstream, attaining a maximum depth of 42 feet at the Monona-Harrison County line.

4519. Davison, V. E., Lawrence, J. M., and Compton, L. V. WATERSHED CONTROL ON FARMS AND RANCHES. U. S. Dept. Agr. F. B. 2181, 22 pp. 1962. 1 Ag84F

Waterweeds present serious problems in agricultural water whether it is impounded for irrigation, livestock, fish, wild ducks, or for other purposes. At least 100 kinds of troublesome waterweeds grow in the South, and no section of the United States is free from them. Some kind of waterweeds or troublesome water plants will invade most impoundments unless they are properly managed. Specific recommended management practices were given for waterweed prevention and waterweed control.

4520. Dickinson, T. A. POLY-LINED RESERVOIR. West. Fruit Grower 14(9): 23. Sept. 1960. 95.8 G762

A report was given on the use of polyethylene plastic to control seepage in an irrigation reservoir in California.

4521. Dirmeyer, R. D. SEDIMENT LINING OF IRRIGATION CANALS. Natl. Reclam. Assoc. Proc. 25: 50-56. 1956. 55.9 N212

A report on the use of high-swell bentonite as a sedimentation agent for lining irrigation canals was given. The ultimate goal of the program is to produce a low-cost, mass production method that can be applied practically in one system-wide operation.

4522. Dirmeyer, R. D. USE OF COLLOIDAL CLAY SEDIMENTS IN SEALING IRRIGATION CANALS. Cong. Irrig. & Drain. Trans. 3(2): 7.75-7.96. 1957. 55.9 C7652

4523. Dirmeyer, R. D. LET'S MUDDY THE DITCH WATER. Colo. Farm & Home Res. 11(4): 3, 8. Jan./Feb. 1961. 100 C712Co

A report was given on the use of Colorado clay to help control seepage losses from irrigation ditches.

4524. Dirmeyer, R. D., Lutz, G. A., and White, L. G. SAMPLING AND TESTING OF COLORADO CLAYS FOR SEALING PURPOSES. Colo. Agr. Expt. Sta. Colo. Prog. Rpt. 93, 2 pp. July 1963. 100 C71C

A progress report was given on the sampling and testing of Colorado clays for sealing ponds and canals.

4525. Dirmeyer, R. D., and Skinner, M. M. METHODS OF USING COLORADO CLAYS FOR SEALING CANALS AND PONDS. Colo. Agr. Expt. Sta. Colo. Prog. Rpt. 91, 2pp. July 1963. 100 C71C

A progress report was given on methods of using clays in Colorado to help seal canals and ponds.

4526. Dirmeyer, R. D., and Skinner, M. M. SEEPAGE REDUCTION WITH COLORADO CLAYS. In U. S. Dept. Agr., Dept. Agr. PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. Res. Serv. ARS-41-90: 100-103. Jan. 1965. A56.9 R31
Discussion, p. 129-131.

A report was given on the use of Colorado clay to reduce seepage losses in Colorado.

4527. Diseker, E. G. DESTROY WEEDS IN DRAINAGE DITCHES. Res. & Farming [N.C. Sta.] 15(1): 15. Summer 1956. 100 N81R

A report was given on the economical control of weeds in drainage ditch by chemicals in North Carolina.

4528. Dootjes, E. CLEANING DRAINAGE PIPES WITH PLASTIC TUBES. (Du) Netherlands. Rlandb-consschap. v. Noordelijk Zuid-Holland. Verslagen en Meded. 2: 15-18. 1955. 12 N3828

4529. Doutre, J. L. PLASTIC LININGS FOR FARM DAMS. New Zeal. J. Agr. 97(1): 47, 49. July 15, 1958. 23 N48J

A report was given on the use of plastic liners for farm reservoirs and ponds on pomice, sand, and peat soils.

4530. Dumay, L. BITUMINOUS LININGS FOR CANALS IN THE CHOTT EL-HONDA (CONSTANTINE, ALGERIA). (Fr) Cong. Irrig. & Drain. Trans. 3(2): 7.133-7.144. 1957. 55.9 C7652

A report was given on the use of bituminous linings for canals in Algeria.

4531. Dunk, W. P. A REPORT DESCRIBING RECENT DEVELOPMENTS IN THE CHEMICAL CONTROL OF WATER WEEDS. Cong. Irrig. & Drain. Trans. 4(6): C.69-C.80. Ref. 1960. 55.9 C7652

The chemical methods were given of control of water weeds in irrigation and drainage canals in Australia.

4532. Dybalski, J. N. CATIONIC CHEMISTRY IN WATER CONSERVATION. In U.S. PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. Agr. Res. Serv. ARS-41-90: 137-141. Jan. 1965. A56.9 R31

A report and discussion were given on the use of surface active agents for water conservation. The use of these agents for seepage control were included.

4533. Edelman, T. SOIL PROBLEMS IN DIKE BUILDING. (Du) Landbk. Tijdschr. 69(2): 136-143. Feb. 1957. 105.2 Or3

4534. Ehrman, K. S. PLASTIC CUTOFF FOR SEEPAGE CONTROL. Reclam. Era 50(3): 58-61. Aug. 1964. 156.84 R24

A report was given on the use of plastic cutoffs for seepage control for irrigation canals in Idaho and Washington.

4535. Elema, H. M. MANY NEW DITCH CLEANERS IN GRIENTSVEEN. (Du) Loonbedrijf in Land-en Tuinbouw 16(10): 647, 649, 651. Oct. 1963. 283.8 L87

4536. Elema, H. M. DITCH CLEANING DEMONSTRATION. (Du) Loonbedrijf in Land-en Tuinbouw 17 (10): 719, 721. Oct. 1964. 283.8 L87

4537. Ellsperman, L. M. BURIED ASPHALT MEMBRANE CANAL LININGS. Cong. Irrig. & Drainage Trans. 3(2): 7.109-7.116. 1957. 55.9 C7652

The development and use of a special asphalt applied as a membrane and protected with an earth cover as a low cost seepage control measure for canals were described. The installation methods and construction techniques used in the United States were emphasized.

4538. Ellsperman, L. M. CHEMICAL CANAL SEALANTS. Reclam. Era 48(1): 6-8. Feb. 1962. 156.84 R24

A report was given on the use of chemical canal sealants in irrigation canals in Wyoming, Idaho, and Arizona.

4539. Ellsperman, L. M., and Hickey, M. E. THE USES OF ASPHALT IN HYDRAULIC CONSTRUCTION BY THE BUREAU OF RECLAMATION, 1946-1959. Third Annu. Kans. Asphalt Paving Conf., U. Kans., Lawrence, Kans. Nov. 5-6, 1959, 33 pp. 1959.

Various types of construction were outlined and the materials and general procedures associated with each type were described. New installation procedures have been devised for some of the older types, and for the newer types, up-to-date conclusions regarding materials and methods were given. Much progress has been made during the past several years towards improving old and developing new uses for asphalt. Many of the types of construction described involved the element of minimum cost. In asphaltic construction, rigid inspection of construction procedures and care in proper design and control of materials were necessary for high efficiency and truly minimum costs.

4540. Erdman, L. W. SOIL AND WATER RESEARCH FOR GROWING RICE. Rice Tech. Working Group Proc. MP-488: 24-25. 1961.

A report was given on soil and water research for growing rice.

4541. Fassetta, L. MACHINES FOR MAINTENANCE OF CANALS. (It) Macch. & Motori Agr. 19(2): 63-66. Feb. 1961. 58.8 M13

4542. Fefer, M., and Condon, J. R. SEEPAGE CONTROL USING BUTYL RUBBER LATEX. In U.S. Dept. Agr. Proceedings, SEEPAGE SYMPOSIUM, Phoenix, Arizona, 1963. Agr. Res. Serv. ARS-41-90: 159-167. Jan. 1965. A56.9 R31

A report was given on the use of butyl rubber latex for seepage control in the following ways: (1) As a lightly-pigmented barrier film; (2) as a modifier for concrete; and (3) as a modifier for asphalt.

4543. Filippov, F., and Motin, Yu. MACHINES FOR CLEANING IRRIGATION AND DRAINAGE DITCHES. (Rus) Tekh. v. Sel'sk. Khoz. 2: 29-34. Feb. 1964. 58.8 M11

4544. Finfrock, D. C. PLASTIC LEVEES IN RICE FIELDS. Down Earth 16(4): 18-19. Spring 1961. 381 D75

A report was given on the use of plastic levees in rice fields in California.

4545. Finfrock, D. C. PLASTIC LEVEES IN RICE FIELDS. World Crops 15(1): 17-18. 1963. 281.8 W892

Rice needs water of uniform depth throughout the field to ensure good growth and satisfactory control of weeds. To provide this, bunds or levees are usually constructed in situ using topsoil. These exposed levees take up useful space and serve as a site for weed growth. The use of black polyethylene film for construction of levees overcame these disadvantages and provided a saving in land preparation and harvest.

Several successful plastic levees were used at the rice experiment station at Biggs, Calif., in 1959-60. Several widths and thickness of plastics were tried at a number of stake spacings. The most desirable construction was with 8-mil black polyethylene 24-28 in. wide, fastened to 1-in. x 2-in. x 30-in. stakes driven 16 in. into the ground at 4-ft. spacings.

4546. Fitzgerald, J. N. WEED CONTROL IN DRAINS. New Zeal. Weed Control Conf. Proc. 9: 115-118. 1956. 79.9 N213

Manual control, mechanical cleaning, and chemical control of weeds in drains were given as used in New Zealand.

4547. Frank, P. A., Hodgson, R. H., and Comes, R. D. EVALUATION OF HERBICIDES APPLIED TO SOIL FOR CONTROL OF AQUATIC WEEDS IN IRRIGATION CANALS. Weeds 11: 124-128. 1963. 79.8 W41

Ninety-one herbicides and experimental compounds were evaluated for herbicidal activity on submersed aquatic weeds, Sago pondweed (Potamogeton pectinatus L.) and American pondweed (P. nodosus Poir.). Twenty-one of the compounds tested showed some phytotoxicity at 20 lb./A. The other compounds were completely inactive. Fenac and dichlobenil showed outstanding activity with good persistence in water-saturated soil. Fenac and silvex were tested in field trials in an irrigation canal in eastern Wyoming. The sodium salt and amide of fenac did not give adequate weed control at 5lb./A. Spring applications of herbicides did not perform as well as fall ones. Mechanical incorporation of herbicides improved some results, but was of doubtful value.

4548. Frolov, N. N. CONSTRUCTION OF [IRRIGATION] CANAL LEVEES ON A SAGGING FOUNDATION BY THE METHOD OF MECHANIZED POURING OFF OF THE LOESS GROUND INTO THE WATER. (Rus) Gidrotekh. i Melior. 10(8): 28-32. Aug. 1958. 290.8 G362

4549. Fujimoto, M., Tanabe, T., and Takahashi, H. ASPHALT ROOFING FOR SEEPAGE PREVENTION WORKS OF IRRIGATION CANALS. (Ja) Nogyodoboku-Kenkyu 26(4): 187-190. Nov. 1958. 290.8 N68

4550. Fujioka, Y., and Nagahori, K. A STUDY ON THE MECHANISMS OF THE PERCOLATION CONTROL OF WATER BY USING BENTONITE. V. (Ja) Agr. Engin. Soc. (Japan). Trans. 4: 31-36. Mar. 1962. 290.9 Ag8
English summary.

A report was given on the use of bentonite to help control percolation of water in the laboratory and in paddy fields of Japan.

4551. Fujioka, Y., Nagahori, K., and Hattori, T. ON THE PERCOLATION CONTROL OF WATER BY USING BENTONITE IN THE EXCESSIVE PERCOLATIVE PADDY FIELD OF VOLCANIC ASH SOILS. (Ja) Agr. Engin. Soc. (Japan). Trans. 9: 31-37. Oct. 1964. 290.9 Ag8
English summary.

A report was given on the use of bentonite for percolation control in the excessive percolative paddy fields of volcanic ash soils in Japan. These soils needed 5 to 6 times as much bentonite as was needed on the alluvial sandy permeable paddy fields in Japan.

4552. Gadein, M. M. A REPORT ON WEED CONTROL IN THE SUDAN GEZIRA IRRIGATION SCHEME. Cong. Irrig. & Drainage Trans. 3(5): C.137-C.160. 1957. 55.9 C7652

A report was given on weed control in irrigation canals in Sudan. Results of land methods, mechanical methods, weed eating fish, and chemical methods were discussed.

4553. Galensa, F. MAINTENANCE OF IRRIGATION DITCHES AND CANALS. (Ge) Lohnunternehmen in Land-u. Forstwirt. 17(3): 58, 60. Mar. 15, 1962. 58.8 D81

4554. Giherd, P. SOIL DRAINAGE IS A NECESSITY--CLEARING DITCHES: 36 MECHANICAL SOLUTIONS. (Fr) Motorisation Agr. 16(171): 29, 31, 35, 37, 39. (Cont.) Sept. 1961. 58.8 M85

4555. Giherd, P. SOIL DRAINAGE IS A NECESSITY; 36 MECHANICAL SOLUTIONS TO THE CLEANING OF DITCHES. (Fr) Motorisation Agr. 16(172): 21, 23, 25, 27. (Concl.) Oct. 1961. 58.8 M85

4556. Glenn, J. H. A POLYMER COMPOUND FOR SEEPAGE REDUCTION. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr. Agr. Res. Serv. ARS-41-90: 141-152. Jan. 1965.
Includes discussion.

A report and discussion were given on the use of Soil Sealer-13 for seepage reduction in irrigation canals.

4557. Glukhov, I. G. SEEPAGE OF WATER FROM CANALS IN LOESS FORMATIONS AND SUBSIDENCE PHENOMENA IN IRRIGATED AREAS. Gidrotekhnika i Melioratsiya 8(10): 9-18. No date given. (Translated from Russian PST Cat. 137, OTS. 60-21152.)

When canals were constructed in loess formations--in loess soils and loess-like loams--subsidence phenomena often occurred, whose remedy entails considerable expenditure. Subsidence, combined with mechanical piping in loess soils, is a grave and dangerous phenomenon, which owing to its suddenness and consequences, resembles local earthquakes.

4558. Gol'din, L. AUGER IRRIGATION DITCH CLEANER. (Rus) Tekh. v Sel'sk. Khoz. 8: 23-25. Aug. 1964. 58.8 M11

4559. Goodrich, K. STOP THE SEEP WITH BENTONITE. Agr. Leaders' Digest 37(4): 22-23, 33. Apr. 1956. 275.28 Am3

A discussion was given on the value of stopping seeps in irrigation canals by bentonite. In Nebraska, it was estimated that sealing a 12-mile long canal cost $15,000, but saved $80,000 worth of water during 1 season.

4560. Gorinskii, V. N. MECHANIZATION OF CLEANING OF DRAINAGE CANALS ABROAD. (Rus) Gidrotekh. i Melior. 8: 57-64. Ref. Aug. 1962. 290.8 G362

4561. Gougler, D. PLASTIC LEVEES FOR RICE FIELDS ARE DEMONSTRATED AT TEXAS STATION. Rice J. 62(10): 22-23. Sept. 1959. 59.8 R36

A report was given on the advantages of the use of plastic levees over dirt levees for rice fields in Texas.

4562. Graage, W. THE EQUIPMENT FOR CLEANING DRAINAGE DITCHES. (Ge) Tech. u. Landwirt. 13(4): 82-83. Feb. 25, 1961. 58.8 T223

4563. Gray, R. W. PLASTIC POND LINER. (Abs.) Assoc. South Agr. Workers. Proc. 54: 199. 1957. 4 C82

A report was given on the installation and performance of a plastic pond liner on an irrigation pond that would not hold water due to large seepage losses.

4564. Green, K. D. PRECAST CONCRETE IRRIGATION CHANNEL FLUMES. Internatl. Comn. Irrig. & Drain. Annu. B. 1959: 82-86. 1959. 55.9 In8A

A description was given of a novel form of precast concrete flume on a main irrigation canal in Australia.

4565. Gres, G. BEHAVIOUR OF BITUMINOUS CONCRETE LININGS IN A LARGE DIVERSION CANAL OF THE RIVER RHONE (FRANCE). (Fr) Cong. Irrig. & Drain. Trans. 3(2): 7.341-7.344. 1957. 559 C7652

A report was given on the use of a bituminous concrete lining and a lining of reinforced concrete slabs for lining a diversion and shipping canal in France.

4566. Grigor'ev, V. D. ON REPAIR OF FOREST DRAINAGE SYSTEMS IN SPHAGNACEOUS AND STAGNANT FOREST TYPES. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 49: 129-134. 1959. 99.9 Ak1

4567. Grigor'ev, V. D. RESTORATION AND REPAIR OF FOREST DRAINAGE SYSTEMS IN SPHAGNOUS AND POLYTRICHACEOUS GROUPS OF FORESTRY TYPES. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS, p. 135-141. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the restoration and maintenance of forest drainage systems in sphagnous and polytrichaceous groups of forestry types in the U.S.S.R.

4568. Grizzell, R. A., Jr., and Neeley, W. W. BIOLOGICAL CONTROLS FOR WATERWEEDS. North Amer. Wildlife and Natl. Resources Conf. Trans. 27: 107-113. 1962. 412.9 N814

Two genera of algae are often serious problems in Southeastern ponds. Pithophora grows in freshwater fish ponds, and Cladophora in brackish-water duck ponds. No suitable chemical has been found to control either one.

Field trials in Georgia and Arkansas confirmed research at Auburn, Ala., that it was practical to establish effective biological reduction of *Pithophora* in bass-bluegill ponds by using 50 Israeli carp per acre. It was necessary to stock with 5- to 6-inch fish, rather than smaller fingerlings, to prevent largemouth bass from depleting the stocking.

Field trials in coastal South Carolina proved that *Cladophora* was effectively controlled in widgeongrass duck ponds when mullet was introduced.

4569. Groot, H. De. WATER CONTROL IN POLDER DISTRICTS. Internatl. Comn. Irrig. & Drain. Annu. B. 1963: 55-61. 1963. 55.9 In8A

A report was given on past and present development of polders in the Netherlands.

4570. Gruner, W. ENGLISH MACHINES FOR MELIORATION, DITCH CLEANING, AND DRAINAGE. (Ge) Deut. Agrartech. 7(4): 157-159. Apr. 1957. 58.8 D482

4571. Haase, H. ARE THE IRRIGATION CANALS CLEANED? (Ge) DLZ--Deut. Landtech. Z. 15(10): 654, 656, 658. Oct. 1964. 58.8 T677

4572. Hall, V. L., Bryan, B., Engler, K., Grant, W., and Mullins, T. PLASTIC LEVEES IN RICE IRRIGATION. Ark. Farm Res. 12(1): 4. Jan./Feb. 1963. 100 Ar42F

A report was given on the use of plastic levees in rice irrigation in Arkansas.

4573. Hallmen, B. PRACTICAL EXPERIENCES WITH THE COVERING OF DITCHES WITH PLASTICS. (Sw) Lantmannen 75(22): 564-566. May 30, 1964. 11 L234

4574. Hamid, C. A. CANAL LINING AS PRACTISED IN PAKISTAN. Cong. Irrig. & Drainage Trans. 3(2): 7.191-7.204. 1957. 55.9 C7652

A report was given on the use of brick and concrete canal linings in Pakistan.

4575. Hanson, E. G. RESEARCH IN DITCH LININGS TO SAVE IRRIGATION WATER. Water Conf. New Mex. A&M Col. [Proc.], Annu. Conf. 9: 46-47. 1964. 292.9 W297

A report was given on a research study on the use of cement ditch linings to save irrigation water.

4576. Hanson, E. G. INFLUENCE OF DITCH LININGS ON SEEPAGE LOSSES FROM FARM DITCHES IN SOUTHWESTERN NEW MEXICO. *In* PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 83-85. Jan. 1965. A56.9 R31 Discussion, p. 97-99.

A report was given on the influence of sitch liners on seepage losses and ditch operation and management expenses in New Mexico.

4577. Hart, F. C. EXPERIENCE WITH SEEPAGE CONTROL IN THE PACIFIC NORTHWEST. *In* PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 167-176, map. Jan. 1965. A56.9 R31

A report and discussion were given on seepage control experiences in the Pacific Northwest.

4578. Henze, J. IS THERE DANGER FROM TREE ROOTS FILLING UP DRAINAGE INSTALLATIONS? (Ge) Erwerbsobstbau 5(7): 122-123. July 1963. 80 Er9

4579. Hilchey, J. D. LAND RECLAMATION THROUGH DYKING AND DRAINAGE. Agr. Inst. Rev. 16(3): 16-18, 30. May/June 1961. 7 Ag8

A report was given on land reclamation by diking and drainage of salt marsh areas in Canada.

4580. Hiltibran, R. C. EFFECT OF ENDOTHAL ON AQUATIC PLANTS. Weeds 11: 256-257. 1963. 79.8 W41

Disodium endothal was applied to a number of emergent and submerged aquatic species and was found to be particularly effective in controlling pondweeds. On *Potamogeton foliosus*, *P. crispus*, and *P. pectinatus*, liquid and granular preparations appeared to be equally effective. Endothal was not very effective on waterwillow, (*Justicia americana*), and creeping waterprimrose, (*Jussiaea repens* L. var. *glabrescens*), although defoliation did occur.

4581. Holmen, H., and Stegman, E. C. CONTROLLING SEEPAGE LOSSES IN IRRIGATION DITCHES. N. Dak. Farm Res. 21(12): 9-12. July/Aug. 1961. 100 N813B

A report was given on the use of buried and exposed polyethylene ditch linings for irrigation ditches in North Dakota.

4582. Holtz, W. G. THICK COMPACTED EARTH LININGS FOR CANALS. Cong. Irrig. & Drainage Trans. 3(2): 7.97-7.108. 1957. 55.9 C7652

A report was given on the construction and use of thick compacted earth linings for irrigation canals in the United States. Information was given on: Design and construction schemes used; the suitability of various types of soils; construction control; and costs.

4583. Holz, W. CHEMICAL WEED CONTROL IN DITCHES. (Ge) Chem. u. Tech. in der Landwirt. 13(6): 185-186, 188. 1962. 384 C4292

4584. Holz, W. CHEMICAL WEED CONTROL IN DITCHES. (Ge) Erwerbsobstbau 5(4): 64-67. Apr. 1963. 80 Er9

4585. Holz, W., and Johannes, H. THE PRESENT DAY SITUATION IN CHEMICAL WEED CONTROL IN DITCHES. (Ge) Nachrbl. des Deut. Pflanzenschutzdienstes 15(10): 145-149. Oct. 1963. 442.9 B832

4586. Hoogers, B. J. THE BOTANICAL RESEARCH OF DITCH VEGETATION. (Du) Wageningen. Inst. v. Biol. en Scheik. Onderz. van Landbgewassen. Meded. 212/219: 65-69. 1963. 60.9 W123
English summary

A report was given on the reaction of ditch vegetation to chemical control in the Netherlands.

4587. Hosoyamada, K. ON THE PERCOLATION THROUGH A MODEL DIKE WITH FREE SURFACE. I. Free Surface and Seepage Surface In Percolation. (Ja) Agr. Engin. Soc. (Japan) Trans. 4: 37-41. Mar. 1962. 290.9 Ag8
English summary.

Results were given of a study made of percolation through a model dike in Japan by free surface and seepage surface.

4588. Hubbard, L. R. STEEL BARREL RISERS CUT COST OF UNDERGROUND IRRIGATION SYSTEM. Soil Conserv. 29(3): 67-68. 1963. 1.6 So35

A report was given on the use of underground pipe with steel barrel risers to prevent seepage losses and problems for pasture irrigation in Nevada.

4589. Hue-Herrero, F. CANAL PROBLEMS IN GYPSEOUS SOILS. Cong. Irrig. & Drainage Trans. 3(2): 7.227-7.243. 1957. 55.9 C7652

A report was given on canal problems and solutions to these problems in gypseous soils in Spain.

4590. Iarovenko, V. V., and Aliev, I. S. ON DIGGING WATER-RETAINING DIKES. (Rus) Zemledelie 4(9): 126-127. Sept. 1956. 20 Z44

4591. Ichikawa, Y. MAKING RICE PADDIES WITH VINYL AND ITS EFFECTIVENESS. (Ja) Nogyo Gumma 41 (9): 106-109. Sept. 1963. 22.5 N6898

4592. Ignatiuk, G. L. PLASTIC MATERIALS FOR CONTROLLING WATER FILTRATION IN [IRRIGATION] CANALS. (Rus) Gidrotekh. i. Melior. 10(8): 8-12. Aug. 1958. 290.8 G362

4593. Indyk, H. W. CHEMICAL CONTROL OF BRUSH ON DRAINAGE DITCH BANKS. Northeastern Weed Control Conf. Proc. 12: 246-256. Ref. 1958. 79.9 N814

Growth of coniferous and deciduous brush along drainage ditches seriously interferes with mechanical maintenance methods where control is neglected for a period of five years or more. Results of research and recommended chemical control methods for brush control on drainage ditch banks in Delaware were given.

4594. Irwin, R. W. CARE AND MAINTENANCE OF THE DRAINAGE SYSTEM. Ontario Dept. Agr. C. 290, 4 pp. Oct. 1956. 7 On8Ci

An illustrated circular was given on the care and maintenance of the drainage system in Ontario, Canada.

4595. Irwin, R. W. DRAINAGE SYSTEM REPAIR RECOMMENDATIONS. Ontario Dept. Agr. C. 333, 4 pp. Nov. 1958. 7 On8Ci

Recommendations were given to assist the farmer whose farm drainage system will be crossed by a Public Utility or other transmission line in Canada. These recommended actions may be included as a section of an agreement between the farmer and the Utility concerned.

Recommendations were given for open ditches, existing tile lines, and future tile lines.

4596. Irwin, R. W. CARE AND MAINTENANCE OF THE DRAINAGE SYSTEM. Ontario Dept. Agr. P. 290, 4 pp. July 1960. 7 On8P

A short report was given on the care and maintenance of the drainage systems in Canada.

4597. Jamison, V. C., and Thornton, J. F. SEALING FARM PONDS IN MISSOURI. Mo. Agr. Expt. Sta. Res. B. 817: 28 pp. 1963. 100 M693

Field and laboratory testing with leaking ponds was reported for making some recommendations for sealing of farm ponds in Missouri.

4598. Jamison, V. C., and Thornton, J. F. SEALING FARM PONDS IN OZARK HIGHLANDS, CENTRAL MISSISSIPPI VALLEY WOODED SLOPES, AND DEEP LOESS HILLS. U. S. Dept. Agr. ARS 41-78, 20 pp. 1963. A56.9 R31

A discussion was given on some reasons for excessive seepage from ponds in Missouri. Field and laboratory tests were reported of the effects of barnyard manure, polyphosphates and silicates, and emulsions to control excessive seepage.

4599. Jerven, O. 4 MILLION METER NEW FOREST DITCHES EVERY YEAR. (No) Norske Myselsk. Meddel. 3: 87-88. June 1962. 11 N813

4600. Jobe, R. N. FRESH WATER MARSHES--FUTURE BREAD BASKET. J. Soil & Water Conserv. 12(3): 120-121. May 1957. 56.8 J822

A report was given on the reclamation by dikes of about 20,000 acres of fresh water marsh in Camden County, Ga. Georgia has about 180,000 acres of these fresh water marshes along the coast. Properly developed, this area could become Georgia's "bread basket."

4601. Johnson, E. G. SOIL-CEMENT FOR CHANNEL STABILIZATION; EVALUATION OF COMPACTED AND PLASTIC SOIL-CEMENT LININGS. Agr. Engin. 43(7): 402-404. July 1962. 58.8 Ag83

A description was given of the installation and use of compacted and plastic soil cement channel linings and their effectiveness were evaluated. Both methods were particularly useful when local or in-place soil materials could be used.

4602. Johnson, G. I., and Huston, W. E. TERRACE MAINTENANCE. Ga. Agr. Col. Ext. C. 260, rev., 6 p.-folder. 1959. 275.29 G29C

A revised edition was given of a Georgia publication on terrace maintenance.

4603. Johnson, H. P., Jacobson, P., and Schwab, E. O. LEAKAGE FROM SMALL RESERVOIRS AS AFFECTED BY POLYPHOSPHATE AND BENTONITE TREATMENT. Trans. ASAE 5(2): 200-201, 203. 1962. 290.9 Am32T

A report was given on the leakage reduction of small reservoirs in Iowa when given the polyphosphate and bentonite treatment. The combined effect of polyphosphate or bentonite treatment and compaction considerably reduced the rate of water loss from the reservoirs, but the problem was not solved by either treatment as used.

4604. Jones, C. W., and Lowitz, C. A. COMPACTED LOESSIAL-SOIL CANAL LININGS. J. Irrig. and Drain. Div., ASCE 88(IR4, pt. 1): 1-22. Dec. 1962. 290.9 Am3Ps

The results were presented of significant field and laboratory tests on loessial type soil of compacted canal linings in southcentral Nebraska. The field seepage tests showed that, although there has been some density decrease in the compacted soil lining, the lining was still effective in reducing seepage to allowable limits.

4605. Jones, C. W., and Lowitz, C. A. COMPACTED LOESSIAL-SOIL CANAL LININGS. Amer. Soc. Cival. Engin. Trans. 128(3): 349-370. 1963. 290.9 Am3

The results were presented of significant field and laboratory tests obtained to date (1962) on loessial-type soil of compacted linings located in southcentral Nebraska. Tests on many soil types in soil linings have shown that the loessial-type soils generally are the most apt to be affected by freezing and thawing. The tests include field density, field seepage by the ponding method, laboratory compaction, Atterberg limits, gradation, permeability, and freeze-thaw. The field seepage tests showed that, although there has been some density decrease in the compacted-soil lining, the lining was still effective in reducing seepage to allowable limits.

4606. Jones, M. J. ASBESTOS CEMENT FLUMES FOR WATER DISTRIBUTION. Internatl. Comn. Irrig. and Drain. Annu. B. 1955, 81-83. 1955. 55.9 IN8A

The use and advantages were given of asbestos cement fluming as a substitute for small lined channels in the distribution of water and other liquids.

4607. Jones, R. M. NEW LIFE FOR THE QUELL-QUEEL GUMS [EUCALYPTUS CAMALDULENSIS]. N. S. Wales. Soil Conserv. J. 20(3): 161-163. July 1964. 56.9 N472

A report was given of the use of a drain to save the queel-queel gum trees where windblown drifts were blocking runoff in Australia.

4608. Kamihasai, K. TAPES FOR PREVENTING WATER FROM LEAKING OUT OF LEVEES AND HOW TO USE THEM. 1. (Ja) Kikaika Nogyo 2540: 70-72. Aug. 1963. 58.8 K55

4609. Kamilova, R., and Bersonova, K. A. CONTROL OF PLANTS CLOGGING DRAINS. (Rus) In Sokolov, N. S., ed. PRIMENENIE GERBITSIDOV V SEL'SKOM KHOZYAISTVE. pp. 252-256. 1962. 79 So3P

4610. Kamilova, R. M., Bersonova, K. A., and Mukhitdinov, U. RESULTS OF TESTS OF SOME HERBICIDES IN A DRAINAGE NETWORK IN UZBEKISTAN. (Rus) Khlopkovodstvo 9: 50-54. Sept. 1962. 72.8 K522

4611. Karvitskii, M. P., and Shamrai, L. N. THE USE OF BENTONITE CLAYS FOR ARRANGING WATERPROOF SCREEN ON IRRIGATION CANALS. (Rus) Gidrotekh. i Melior. 1961(7): 29-34. July. 290.8 G362

4612. Kingsbury, A. E. MAINTENANCE OF SMALL EARTHEN CHANNELS: USE OF THE BACK-HOE. Internatl. Comn. Irrig. and Drain. Annu. B. 1955: 11-13. 1955. 55.9 IN8A

A back-hoe was described as a special type developed in Australia for cleaning irrigation channels. Some details were given of its performance.

4613. Kinmont, R. M. AFTER-CARE AND MANAGEMENT OF SOIL CONSERVATION EARTHWORKS IN THE LOCKHART-BERRIGAN AREA. N. S. Wales. Soil Conserv. Serv. J. 19(2): 81-92. Ref. Apr. 1963. 56.9 N472

A report was given on the care and management of terraces, grassed waterways, flumes and other methods of soil conservation methods to reduce erosion in New Zealand.

4614. Kita, D., Tarumi, H., Mori, H., and Kawaguchi, K. A NEW THEORY ON THE FUNCTION OF BENTONITE IN SUPPRESSING THE WATER PERCOLATION THROUGH SOILS. (Ja) J. Sci. Soil & Manure 35 (2): 47-52. Feb. 1964. 56.8 J27
English Abstracts--Soil Sci. & Plant Nutr. 10(4): 45. 1964. 56.8 So38

A new theory was given for the function of bentonite in suppressing the water percolation through soils.

4615. Koester, J. CONCRETE LINED CANALS IN TEXAS. Irrig. Engin. & Maintenance 7(2): 18, 27-28. Feb. 1957. 55.8 Ir722

A report was given on the use and advantage of concrete lined canals in Texas. The following four general types are used: (1) Rail-mounted slipform concrete; (2) shotcrete; (3) subgrade supported slipform concrete; and (4) hand placed.

4616. Korhonen, K. H. ON FAILURES OF DRAINING CHANNELS BY SLIDING AND ON THE METHODS EMPLOYED FOR THEIR PREVENTION. (Fi) Maa- ja Vesitek. Tutkimuksia 10,131 p. Ref. 1962. 56.8 M11 English summary.

A report was given on the failure of drainage canals in Finland due to sliding earth. Methods employed to prevent these failures were discussed.

4617. Koshkin, V. V., and Millerov, K. V. CHEMISTRY AND ITS SERVICE TO IRRIGATION. (Rus) Kolkhoz.-Sovkhoz. Proizvodstvo Tadzhikistana 2: 55-57. Feb. 1964. 20 Se494

4618. Kramer. NOTES ON THE TECHNIQUE OF CHEMICAL WEED CONTROL IN DITCHES. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(5): 213-215. May 1964. 18 W763

4619. Kramer. CHEMICAL CARE OF SLOPES. (Ge) Wiss-Tech. Fortschr. f. die Landwirt 5(6): 261-262, June 1964. 18 W763

4620. Kramer, D. USE OF HERBICIDES IN CHEMICAL ERADICATION OF WEEDS IN DRAINAGE CANALS. (Ge) Deut. Akad. der Landwirtwiss. Tagungsber. 21: 43-56. 1960. 18 D4825T English summary.

A report was given on chemical weed killing methods used in Germany to control aquatic plants in drainage and irrigation ditches.

4621. Kramer, D. NEW PROCEDURES IN THE MAINTENANCE OF DRAINAGE DITCHES. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 4(3): 115-118. Mar. 1963. 18 W763

4622. Kramer, D., and Taeger, H. WORKING DIRECTIONS FOR THE MAINTENANCE OF DRAINS. (Ge) Deut. Landwirt. 13(7): 351-353. July 1962. 18 D4822

4623. Kraus, H., and Grimm, C. MECHANIZATION OF DITCH CLEANING WORK. (Ge) Mitt. f. Landkult. Moor- u. Torfwirt. 7(1): 18-31. Mar. 1959. 60.1 M69

4624. Kretchman, D. W. CONTROLLING WEEDS AND BRUSH IN CITRUS GROVE DITCHES. South. Weed Conf. Proc. 13: 53-61. 1960. 79.9 So8

A report was given of chemical weed control methods used in citrus groves in Florida to control weeds and brush in drainage ditches. None of the treatments used caused any apparent injury to large bearing orange and grapefruit trees 30 feet away.

4625. Krochin, S. SOIL-CEMENT FOR CANAL LININGS. Internatl. Comn. Irrig. & Drain. Annu. B. 1960: 101-108. 1960. 55.9 In8A

A report was given on the use of soil-cement to line canals in Ecuador to prevent seepage and other damages.

4626. Kuntze, H. DRAINAGE FLUSHING AN IMPORTANT ADDITIONAL TASK FOR THE AGRICULTURAL CONTRACT LABOR. (Ge) Lohnunternehmen in Land- u. Forstwirt. 17(2): 27-28, 30. Feb. 15, 1962. 58.8 D81

4627. Laar, H. J. Van De. CONTROL OF WEEDS IN DITCHES. (Du) Boskoop. Ver. Proefsta. v. de Boomkwekerij, Jaarb. 1960: 123-125. 1960. 86 B65

4628. Langford, T. R. DRAINAGE DITCHES WITH BRUSH PROBLEMS. Pub. Works 94(3): 105-106. Mar. 1963. 290.8 M922

A report was given on the value of removing the brush from drainage ditches in Texas by brush cutting and chemical control.

4629. Lastochkin, D. S. MECHANIZATION OF CANAL-CLEANING OPERATIONS. (Rus) Sel'khozmachina 1956 (12): 21-23. Dec. 1956. 58.8 Se42

4630. Lastochkina, L. A. CONTROL OF WATER LOSSES FROM THE IRRIGATION CANALS ALONG THE DOWNSTREAM OF AMU-DARYA. (Rus) In Akademiia Nauk. Sovet po Izucheniiu Proizvoditel'nykh Sil. VOPROSY OROSHENIIA V NIZOV'IAKH AMU-DAR'I. Moskva, Akademiia Nauk SSSR, pp. 136-157. Ref. 1956. 55 Ak13V

4631. Lauritizen, C. W. SOIL STABILIZERS FOR SEEPAGE CONTROL IN IRRIGATION CANALS AND RESERVOIRS. Indus. and Engin. Chem. 47: 2245-2248. 1955. 381 J825

Seepage losses from canals and reservoirs in irrigated lands are the source of much economic waste. These losses can be controlled by lining. Many types of linings have been used with varying degrees of effectiveness. The results of treating soil material with stabilizer AM 955 were presented. The possibility of employing this stabilizer to control seepage losses in irrigation canals and reservoirs was discussed.

4632. Lauritzen, C. W. WAYS TO CONTROL LOSSES FROM SEEPAGE. U. S. Dept. Agr., Agr. Ybk. 1955: 311-320. 1955. 1 Ag84Y

A report on the seepage losses in reservoirs and canals was given along with methods of lining reservoirs and canals to prevent this loss. Pipes are the most efficient way to convey irrigation water and provide maximum control.

4633. Lauritzen, C. W. SOIL STABILIZERS FOR SEEPAGE CONTROL IN IRRIGATION CANALS AND RESERVOIRS. Indus. & Engin. Chem. 47: 2245-2248. Nov. 1955. 381 J825

The results of treating soil material with stabilizer AM955 were presented. The possibility of employing this stabilizer to control seepage losses in irrigation canals and reservoirs was discussed.

4634. Lauritzen, C. W. SEEPAGE CONTROL WITH PLASTIC FILM. Irrig. Engin. & Maintenance 7(5): 18-19, 32-33. May 1957. 55.8 Ir722

The advantages of plastic film for canal and reservoir linings were given.

4635. Lauritzen, C. W. SEEPAGE CONTROL WITH PLASTIC FILM. AN AMERICAN REPORT. Australas. Irrig. 2(9): 11-14. Aug. 1957. 55.8 Au7

Seepage control with plastic film was discussed for irrigation canals and reservoirs.

4636. Lauritzen, C. W. CANAL AND RESERVOIR LINING MATERIALS. Cong. Irrig. & Drain. Trans. 3(2): 7.245-7.257. 1957. 55.9 C7652

A report was given on the various materials used to line canals and reservoirs in the United States.

Canals and reservoirs are usually lined to reduce effluent seepage, which wastes water and causes waterlogging and salinity problems on lower-lying lands, and to protect the canal or reservoir against structural failure. Linings are sometimes installed to reduce operation and maintenance costs. Selection of the proper type of lining is dependent upon both structural and economic factors.

4637. Lauritzen, C. W. Linings For Irrigation Canals. I. Irrig. Engin. Maintenance. 9(13): 10-11. 1959. 55.8 Ir722

A report was given on the use and construction of paved or hard surfaced linings and exposed membrane linings for seepage control in irrigation canals.

4638. Lauritzen, C. W. LININGS FOR IRRIGATION CANALS. II. Irrig. Engin. Maintenance 10(1): 12-13, 21. 1960. 55.8 Ir722

A discussion was given on the use of earth linings and buried membrane linings for lining irrigation canals.

4639. Lauritzen, C. W. ASPHALT-COATED JUTE LINER DEVELOPED FOR CANALS AND RESERVOIRS. Farm & Home Sci. [Utah Sta.] 21(1): 12-13, 28-29. Mar. 1960. 100 Ut1F

The installation and use were described for an asphalt-coated jute liner developed for seepage control of canals and reservoirs in Utah.

4640. Lauritzen, C. W. PLASTIC LININGS SAVE IRRIGATION WATER. Crops and Soils 12(7): 26. 1960. 6 W55

Plastic liners installed in Utah reservoirs and canals were still controlling seepage after 5 years.

4641. Lauritzen, C. W. PLASTIC FILMS FOR WATER STORAGE. Amer. Water Works Assoc. J. 53(2): 135-140. Feb. 1961. 292.9 Am32J

A report was given on the use of plastic films for water storage in reservoirs and irrigation canals in the United States.

4642. Lauritzen, C. W. LINING IRRIGATION LATERALS AND FARM DITCHES. U. S. Dept. Agr., Agr. Inform. B. 242.11 p. Nov. 1961. 1 Ag84Ab

A report was given on the need, design, construction and use of lined irrigation laterals and farm ditches. The various lining materials and equipment for installing the linings were described and illustrated.

4643. Lauritzen, C. W. CONVEYANCE LOSSES IN IRRIGATION SYSTEMS AND MEASURES FOR CONTROL. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 93-99. Jan. 1965. A56.9 R31

A report and discussion were given on the use of lower cost liners to reduce conveyance losses in irrigation systems.

4644. Lauritzen, C. W., and Haws, F. W. ASPHALT-BURLAP LININGS FOR CANALS AND RESERVOIRS. Agr. Engin. 40(6): 340-342, 344. June 1959. 58.8 Ag83

A report was given on the use of asphalt-burlap linings for canals and reservoirs.

4645. Lauritzen, C. W., Haws, F. W., and Humpherys, A. S. PLASTIC FILM FOR CONTROLLING SEEPAGE LOSSES IN FARM RESERVOIRS. Utah Agr. Expt. Sta. B. 391, 18 pp. July 1956. 100 Ut1

A report was given on the use of plastic film for controlling seepage losses in farm reservoirs in Utah.

4646. Lawrence, J. M. AQUATIC HERBICIDE DATA. U. S. Dept. Agr., Agr. Res. Serv. Agr. Hbk. 231, 131 pp. 1962.

The first section of this handbook is a listing of the chemicals for which data are available. Next is a plant index, which includes listings of all genera and species of higher plants on which screening tests and field chemical-control data has been recorded. The listing of higher plants is divided into groups of submerged, emergent, marginal, floating, and miscellaneous weeds.

The last section is the bibliography in two parts. The first part contains references on the toxicity of aquatic herbicides and related compounds to fish and other aquatic animals. The second part contains references on chemical control of aquatic weeds.

4647. Lee, B. F., Jr. YOU'LL LIKE BENTONITE; IT SAVES IRRIGATION WATER. What's New? Crops & Soils 9(3): 12-13. Dec. 1956. 6 W55

The advantages were given for using bentonite for seepage control in irrigation canals. Bentonite-lined canals running through sandy and loessial soils have proved the most satisfactory to date.

4648. Lewis, D. C., Scott, V. H., Mueller, K. E., Viste, K. L., Babb, A. F., and Fox, D. R. PLASTIC RICE LEVEES SHOWN ECONOMICALLY FEASIBLE. Calif. Agr. 16(3): 8-10. Mar. 1962. 100 C12Cag

A report was given on the economical feasibility of using plastic rice levees in California.

4649. Lewis, D. C., Scott, V. H., Muller, K. E., Viste, K. L., Babb, A. F., and Fox, D. R. NEW RICE LEVEE CONCEPTS. Rice J. 65(4): 6, 8, 10-15. Apr. 1962. 59.8 R36

A report was given on the use of economics of use of plastic levees and soil levees for rice production in California.

4650. Lindquist, R. "DELUGE" AND DITCHING. (Sw) Malmöhus Läns Hushållsk. Kvrtlskr. 1: 68-72. 1961. 11 M29

4651. Liptak, F., and Ollos, G. SEEPAGE FROM LINED AND SEALED IRRIGATION CANALS. (Hu) Vizugyi Kozlem. 4: 549-574. Ref. 1964. 290.9 H89 English summary, p. (89)-(90).

A report was given of the difference of seepage from irrigation canals lined with concrete slabs and those lined with concrete and sealed with plastic foil in Hungary.

4652. Lobanov, I. GUNITE LINING THIS DITCH IN THE HILLS STOPS WATER LOSS. Land Impr. 6(8): 14-15. 1959. 282.8 L224

Adding a gunite lining to 1,042 feet of a 2-mile community ditch stopped 30 percent of the seepage loss and eased the cleaning and upkeep problem of the ditch. It now takes 8 minutes for water to travel the gunite section, where it used to take 1 1/2 hours. The lining starts where the water comes out of a 100 foot flume on the hillside.

The finished ditch is 24 inches at the bottom, 54 inches across the top, and 15 inches deep. The total cost was $2,131.93 or 15 cents per square foot of ditch surface.

4653. Lofgren, B. E. NEAR-SURFACE LAND SUBSIDENCE IN WESTERN SAN JOAQUIN VALLEY, CALIFORNIA. J. Geophysical Res. 65(3): 1053-1062, maps. Mar. 1960. 470 J823

A report was given on land subsidence near the surface on irrigated areas in California.

4654. Loginov, M. M. CONTROL OF THE LOSS OF WATER IN CANALS DUE TO FILTRATION BY THE SMOOTHING OUT METHOD. (Rus) Sel'sk. Khoz. Sev. Kavkaz. 1958(7): 79-81. July 1958. 20 Se495

4655. McCart, R. CHEMICAL WEED CONTROL IN DRAIN DITCHES. Calif. Mosquito Control Assoc. Proc. & Papers 28: 79-80. 1960. 428 C673

A report was given on the effect and use of chemical herbicides for weed control in drain ditches in California to improve drainage for better mosquito control.

4656. McIntyre, A. M. CONCRETE LINING OF IRRIGATION CHANNELS IN QUEENSLAND. Cong. Irrig. & Drainage Trans. 3(2): 7.67-7.74. 1957. 55.9 C7652

A report was given on the construction and use of concrete lining of irrigation canals in Australia.

4657. McSwain, K. R. CANAL LINING PROBLEMS. Natl. Reclam. Assoc. Proc. 30: 101-104. 1961. 55.9 N212

A report was given on the solving of some canal lining problems in an irrigation district in California.

4658. Mansur, C. I., and Kaufman, R. I. UNDERSEEPAGE, MISSISSIPPI RIVER LEVEES, ST. LOUIS DISTRICT. Amer. Soc. Cival Engin. Trans. 122: 985-1008. 1957. 290.9 Am3

A description of the underseepage problem along the Mississippi River levees between Alton (Ill.) and Gale (Ill.) and of the procedures used to design seepage-control measures were given. The paper includes: (1) A description of the investigations conducted; (2) the methods used to control the seepage; (3) examples of the design of the control measures; and (4) a description of the construction procedures used to install the control measures.

4659. Marjai, G. PROTECTION AGAINST WATER LOSS DAMAGES OF IRRIGATION CANALS. (Hu) Magyar Mezőgazdasag 16(29): 15-16. July 19, 1961. 19 M27

4660. Marr, J. C. SINKHOLES IN IRRIGATED FIELDS. Calif. Agr. 9(11): 6-7. Nov. 1955. 100 C12Cag

A report was given on a study of sinkholes in irrigated fields in California. Soil covered, debris-filled channels of former streams may be one cause of sinkholes during irrigation.

The surest way to keep sinkholes from developing in irrigated fields is to avoid ponding or running the water over the soil surface by using pipe lines or concrete lined ditches and applying it on overhead irrigation system.

4661. Martinetti, R. BETTER CARE OF DITCHES NECESSARY. (It) Romagna Agr. e Zootec. 45(10): 213-217. Oct. 1960. 16 R66

4662. Mayhew, J. K., and Runkel, S. T. THE CONTROL OF NUISANCE AQUATIC VEGETATION WITH BLACK POLYETHYLENE PLASTIC. Iowa Acad. Sci. Proc. 69: 302-309. 1962. 500 Io93

Large sheets of black polyethylene plastic were used to control nuisance aquatic vegetation in small ponds and lakes. The plastic was floated over vegetation beds and left unattended for a predetermined number of days. Adequate control of all species of Potomageton was achieved in 10 to 18 days. Ceratophyllum demersum was eliminated in the control plots in 18 to 28 days. Control was unsuccessful for Chara vulgaris and Saggattarius latifolia. All control plots were revegetated with filamentous algae within 30 days after the covering was removed.

4663. Merbitz, H. IMPROVEMENT OF OLD DRAINAGE SYSTEMS. (Ge) Mitt. der Deut. Landwirt.-Gesell. 77(32): 1084-1086, 1088. Aug. 9, 1962. 18 N39

4664. Micheljak, E. 15 YEARS AGRICULTURAL DIKE CONSTRUCTION IN AUSTRIA, 1946-1960. (Ge) Oesterr. Wasserwirt. 13(10): 252-256. Oct. 1961. 55.8 Oe8

4665. Mitskis, R. M. EFFECTIVENESS OF STRENGTHENING OF DRAINAGE CANALS IN LITHUANIAN S. S. R. (Rus) Gidrotekh. i Melior. 4: 30-37. Apr. 1963. 290.8 G362

4666. Mochalov, L. P. SAGGING DEFORMATIONS OF IRRIGATION CANALS. (Rus) Gidrotekh. i Melior. 1961(3): 56-60, map. Mar. 1961. 290.8 G362

4667. Molin, M. LINING OF PRINCIPAL CANALS IN MOROCCO. (Fr) Cong. Irrig. & Drain. Trans. 3(2): 7.259-7.284. 1957. 55.9 C7652

A report was given on the materials and equipment used to line principal canals in Morocco.

4668. Molinari, C. BITUMINOUS LININGS USED EXPERIMENTALLY FOR BED AND SIDES OF IRRIGATION CANALS. (It) Acqua nell'Agr. nell'Ig. e nell'Indus. 41(4): 105-108. July/Aug. 1963. 290.8 Ac7
English summary.

A report was given on the results of bituminous linings used for irrigation canals in clay soils in Italy.

4669. Monolts. MODERN DITCH CLEANING. (Ge) Landmasch.-Markt. 37(24): 1014-1016. Dec. 2, 1958. 58.8 L239

4670. Mort, H. D. THE CONTROL OF OUTLET BUILD-UP IN BANK CHANNELS. N. S. Wales. Soil Conserv. Serv. J. 16(2): 142-145. Apr. 1960. 56.9 N472

A report was given on the causes and ways to preserve a build-up of vegetation, silt, and trash in outlets for bank channels in New South Wales. Cultural and mechanical methods used to reduce outlet build-up were described.

4671. Muller-Feuga, R. ORIGINAL METHODS FOR LINING SECTIONS OF CANALS WITH CONCRETE. (Fr) Cong. Irrig. & Drain. Trans., C.1.29-C.2.38, map. 1963. 55.9 C7652

4672. Myers, L. E., Jr. CONSERVATION OF IRRIGATION WATER SUPPLIES IN ARID CLIMATES. In Beetle, A. A., ed. AGRICULTURAL PROBLEMS IN ARID AND SEMIARID ENVIRONMENTS. Wyo. Agr. Expt. Sta. B. 367: 39-44. 1960. 100 W99

A discussion was given of methods for improving irrigation efficiency - including use of lined irrigation canals.

4673. Neumeyer. DITCH CLEANING--BENEFIT OR TROUBLE. (Ge) DLZ--Deut. Landtech. Z. 10(3): 88, 90. Mar. 1959. 58.8 T677

4674. Nienaber, H. DRAINAGE REPAIRS--WORK FOR WINTER. (Ge) Deut. Landwirt.-Gesell. Mitt. 71: 1241-1242. Nov. 29, 1956. 18 N39

4675. Nikolaev, I. I., and Kharin, A. I. FROM THE OPERATION OF SUCTION DREDGE APPARATUS FOR CLEARING IRRIGATION CANALS FROM DRIFT. (Rus) Gidrotekh. i Melior: 8(11): 36-41. Nov. 1956. 290.8 G362

4676. Norton, J. S. CLEANING CRANBERRY BOG DITCHES--A NEW TECHNIQUE. Mass. Agr. Expt. Sta. B. 527, 10 pp. Jan. 1962. 100 M38H

A report was given on the construction and use of a cranberry bog ditch cleaner in Massachusett

4677. Novikovskii, V. E., and Sokol'skaya, V. V. SOME EXPERIENCE IN APPLYING POLYETHYLENE FILMS AS SCREENS TO CONTROL SEEPAGE LOSSES FROM CANALS AND RESERVOIRS. (Rus) Gidrotekh. i Melior. 1961(4): 22-29. Apr. 1961. 290.8 G362

4678. Ohama, F. ABOUT CONCRETE FOR CANAL LINING. (Ja) Mie U. Facul. Agr. B. 25: 33-44. Ref. Feb. 1962. 107.6 T78
English summary.

Problems related to the use of concrete canal linings in Japan were discussed.

4679. Olbertz, M. H. CONSTRUCTION AND OPERATION OF THE ROSTOCK RSO II DRAIN COIL AND LOCATING EQUIPMENT. (Ge) Z. f. Landeskult. 5(2):95-110. 1964. 282.9 Z3
English summary.

A report was given on the construction and use of a drain coil to clean tile drainage in place and detect broken tile.

4680. Olivecrona, C. M. B. SIDE-MOUNTED DRAIN CLEANER. New Zeal. J. Agr. 96(1): 53. 1958. 23 N48

A side-mounted tractor driven open drain cleaner used in New Zealand was described.

4681. Olsen, O. B. WASHING DOWN DRAINAGE PIPES. (No) Norsk Landbr. 13: 14-15. 1964. 11 N8122

4682. Padoan, G., Terenzio, U., and Todaro, U. SOME ASPECTS OF THE PROBLEM OF THE LINING OF IRRIGATION CANAL LININGS IN ITALY. Cong. Irrig. & Drainage Trans. 3(2): 7.369-7.406. 1957. 55.9 C7652

A report was given on the need and use of canal linings in Italy. Self-supporting linings of reinforced concrete made out of monolithic pre-manufactured sections to form the canal itself were described and illustrated by model.

4683. Paicao, J. D. C. USE OF HERBICIDES IN THE CLEANING OF DITCHES AND CANALS IN THE SEPETIBA LOWLANDS. (Por) Seminario Bras. de Herbicides e Ervas Daninhas. An. 2: 147-154. 1958, pub. 1959. 79.9 Se5A
Includes discussion.

4684. Palmer, R. S. RIVER-TERRACE DIKING FOR GULLY CONTROL. Trans. ASAE 6(4): 325-327. 1963. 290.9 Am32T

A report was given on the use and maintenance of ditches and dry wells on river terraces to prevent gully erosion in Connecticut.

4685. Pearce, G. A. WEED RESEARCH: VI. WEED CONTROL IN CHANNELS. West. Austral. Dept. Agr. J. (ser. 3) 8(6): 729-734. Nov./Dec. 1959. 23 W52J

A report was given on mechanical and chemical weed control methods used in drainage and irrigation ditches in Australia.

4686. Penny, J. M. TRIALS WITH MOVABLE WALLS. (Por) Lav. Arroz. 17(193): 13-14. Mar./Apr. 1963. 59.8 L39

4687. Penny, J. M. TEST OF A MOVABLE WALL. (Por) Lav. Arroz. 17(194): 4-5. May 1963. 59.8 L39

4688. Perenyi, K. SHELL CANALS IN IRRIGATION. (Hu) Vizugyi Kozlem. 4: 575-600. Ref. 1964. 290.9 H89

4689. Perk, G. D. DITCH MAINTENANCE. (Du) Netherlands. Rlandbcons. v. Utrecht. Bedrijfsvoorlichting Jaarno. 1959: 6-7. 1959. 12 N3833J

4690. Podstanek, B. MAINTENANCE OF AMELIORATION WORKS. I. (Cz) v Bratislave, Slovenske vydavatelstvo podahospodarskej literatury, 157 pp. 1963. 54 P754

4691. Poggiolini, G. THE MALPASSET DIKE. (It) Acqua e il Suolo 12(1): 5-14, map. Jan./Feb. 1960. 55.8 Ac7

4692. Politov, A. K. USE OF HERBICIDES IN HYDROTECHNICAL CONSTRUCTIONS. (Rus) Sel'sk. Khoz. Sev. Kavkaz. 1960(11): 90. Nov. 1960. 20 Se495

4693. Ragazzi, G. CHEMICAL WEED CONTROL TESTS IN THE RECLAMATION CANALS OF THE PO DELTA. (It) Agr. Ferrarese 65(6): 108-110. June 30, 1961. 16 Ag87

4694. Rattier, C. THE USE OF PLASTIC FACINGS IN THE REPAIR OF CONCRETE CANALS. Cong. Irrig. & Drain. Trans. 3(2): 7.117-7.120. 1957. 55.9 C7652

A report was given on the use of plastic facings, containing bitumen of tar, to repair reinforced concrete canals in Algeria where the canals have been damaged by magnesium sulfate in the irrigation water.

4695. Regt, S. A. De. WATER SUPPLY; A COMPLEX PROBLEM. III. (Du) Groenten en Fruit 19(4): 191. July 24, 1963. 80 G89

4696. Restuccia, G. WEED CONTROL TESTS IN RECLAMATION DITCHES IN THE CATANIA PLAIN. (It) Italia Agr. 100(5): 501-506. Mar. 1963. 16 It1

4697. Roberts, E. SOIL PROBLEMS IN THE NORTHERN REGION. N. A. A. S. Q. Rev. 14(59): 130-134. Spring 1963. 241 G796

A report was given on soil problems in Northern England. A brief discussion was given to the drainage problems in the area and of the value of improving surface drainage and drainage for old covered drains.

4698. Robinson, A. R. SEEPAGE MEASUREMENT AND ITS RELATION TO DRAINAGE AND CANAL LINING PROGRAMS. J. Soil & Water Conserv. 11: 79-81. Mar. 1956. 56.8 J822

A study of canal seepage problems in Colorado was reported. It was concluded that reliable methods of measuring seepage is necessary in determining the economic feasibility for undertaking canal lining programs for the reduction of water losses due to seepage. The methods of measuring seepage now in use were described and it was concluded that the ponding tests gave the most reliable results.

4699. Rollins, M. B., and Dylla, A. S. LEAKY IRRIGATION CANALS LOSE ENORMOUS AMOUNT OF WATER, BUT BENTONITE CAN REDUCE SEEPAGE LOSS; ECONOMICAL, EASY TO USE, CAN BE APPLIED TWO WAYS. Nev. Ranch and Home Rev. 2(5, i.e.6): 14-15. Spring/Summer 1963. 60.18 Sci2

A report was given on the use of bentonite to reduce seepage losses in irrigation canals in Nevada.

4700. Rollins, M. B., and Dylla, A. S. FIELD EXPERIMENTS ON SEALING PERMEABLE FINE SAND WITH BENTONITE. Soil Sci. Soc. Amer. Proc. 28(2): 268-271. Ref. Mar./Apr. 1964. 56.9 So3

Field experiments were reported on the use of bentonite for seepage control in irrigation canals and ditches on a permeable fine sand in Nevada. The bentonite effectively sealed fine sand with initial wetting, but lost some of the seal when allowed to dry.

4701. Rollins, M. B., Dylla, A. S., and Myles, G. A. EXPERIMENTAL BENTONITE SEALING. Nev. Agr. Expt. Sta. B. 229, 11 pp. June 1963. 100 N41S

Experiments were reported on the use of bentonite for sealing irrigation canals in Nevada.

4702. Rozenberga, V. USE OF HERBICIDES FOR CONTROL OF OVERGROWING OF DRAINAGE CANALS. (Rus) Nauch. Konf. po Zashch. Rast. Sborn. Dok. 1960: 412-419. 1962. 464.9 N22

4703. Rundle, V. A., Watson, C. E., and Chapdelaine, P. W. METHODS FOR APPLYING WATERBORNE PETROLEUM SOIL SEALANTS. In PROCEEDINGS, SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr., Agr. Res. Serv. ARS 41-90: 152-159. Jan. 1965. A65.9 R31

A report was given on the various application methods that are used for applying waterborne petroleum soil sealants for seepage control of canals and reservoirs.

4704. Sain, K. CANAL LINING IN INDIA. Cong. Irrig. & Drainage Trans. 3(2): 7.145-7.175. Ref. 1957. 55.9 C7652

A report was given on the need and use of canal linings in India.

4705. Sandahl, K. MECHANICAL CLEANING OF DRAINAGE PIPES. (Da) Hedeselsk. Tidsskr. 84(12): 291-297. Sept. 25, 1963. 11 H35

4706. Sannikov, G. P. DESTRUCTION OF BRUSHWOOD ALONG DRAINAGE SYSTEMS. (Rus) Zemledelie 9: 73-77. Sept. 1963. 20 Z44

4707. Savkin, V. NEW MACHINES FOR CLOSED DRAINAGE. (Rus) Tekh. v Sel'sk. Khoz. 1960(8): 87-89. Aug. 1960. 58.8 M11

4708. Savkin, V. I. MACHINERY FOR CLEANING OF DRAINAGE CANALS. (Rus) Sel'sk. Khoz. Sev.-Zapadnoi Zony 1961(6): 69-70. June 1961. 20 Se497

4709. Savonuzzi, M., and Castagnetta, V. BITUMINOUS LININGS FOR IRRIGATION CANALS. (It) Acqua nell'Agr. nell'Ig. e nell'Indus. 37(4): 94-98. July/Aug. 1959. 290.8 Ac7

Some methods were descriptive of lining irrigation canals in Italy with bituminous materials of various kinds. Characteristic use and construction techniques employed in different applications were indicated.

4710. Scheer, H. INDOMITABLE DUTCH RESTORE LAND HIT BY FLOOD. Excavating Engin. 50(7): 40-43, 69. July 1956. 290.8 Ex2

An illustrated report was given on the reclamation of land hit by the flood of Jan. 31, 1953. About 400,000 acres of land were flooded. The dikes were rebuilt, the polders pumped dry, and the soil had to be restored.

4711. Scherings, H., and Huisman, H. THE CLEANING OF DRAINS. (Du) Netherlands. Dir. van de Landb. Verslag van het Landbk. Onderz. in Noordelijk-Groningen 1958: 114-119. 1958. 12 N38Vg

4712. Scherings, H., and Huisman, H. THE CLEANING OF DRAINAGE DITCHES. (Du) Netherlands. Rlandbvoorlichtingsdienst. Landvoorlichting. 16(2): 79-83. Feb. 1959. 12 N383M

4713. Schinke, H. EVALUATION OF DITCH CLEANING MACHINES. (Ge) Deut. Agrartech. 14(1): 27-28. Jan. 1964. 58.8 D482

4714. Schinke, H. MECHANICAL DITCH CLEANING USING A NEW TECHNIQUE. (Ge) Deut. Agrartech. 14 (12): 550-551. Dec. 1964. 48.8 D482

4715. Schmidt, H., and Schmitt, W. EQUIPMENT AND MACHINES FOR MAINTENANCE AND REPAIR OF WATER COURSES. (Ge) Germany. Land- u. Hauswirt. Auswertungs- u. Informdienst. [Veroffentl.] 124, rev., various paging. 1961. 18 G312V

4716. Scott, V. H. SMALL DITCH SEEPAGE CONTROLLED. Calif. Agr. 9(11): 9, 14. Nov. 1955. 100 C12Cag

A report was given on the use of prefabricated linings to control seepage of small ditches in California. Buried and surface linings of asphalt, asbestos, wood fiber, laminated paper, and plastic vinyl and polyethylene films were studied. All linings reduced the seepage loss over that of the unlined section. The plastic film gave the best (97 percent) seepage control.

4717. Scott, V. H. PREFABRICATED DITCH LININGS. Calif. Agr. 11(4): 28-29. Apr. 1957. 100 C12Cag

A report was given on the effectiveness of various types of liners in irrigation ditches to control seepage and vegetation.

4718. Scott, V. H. PREFABRICATED DITCH LININGS. Fruit and Veg. Rev. 19(2): 16-17. May 1957. 80 C1224

A report was given on a 3-year field and laboratory study of the following prefabricated ditch linings: Asphalt; asbestos, wood-fiber, plastic coated kraft papers; vinyl films, and polyethylene films.

4719. Scott, V. H., Lewis, D. C., Fox, D. R., and Babb, A. F. PLASTIC LEVEES FOR RICE IRRIGATION. Calif. Agr. 15(11): 8-9. Nov. 1961. 100 C12Cag

A report was given on the use and construction of plastic levees for rice irrigation in California.

4720. Scott, V. H., Lewis, D. C., Fox, D. R., and Babb, F. A. PLASTIC LEVEES FOR PADDY IRRIGATION. World Farming 4(4): 28-29, 52. Apr. 1962. 30.08 W89

A report was given on the advantages and use of plastic levees for paddy irrigation in California.

4721. Seaman, D. E., and Porterfield, W. A. CONTROL OF AQUATIC WEEDS BY THE SNAIL *MARISA CORNUARIETIS*. Weeds. 12(2): 87-91. 1964. 79.8 W41

Experiments were conducted in 200-gal. concrete tanks to evaluate a large fresh water snail, *Marisa cornuarietis*, as a biological aquatic weed control agent. Adult *Marisa* snails were collected from a canal near Miami, Fla. These snails are of South American origin and appear identical to those being used in Puerto Rico for biological control of *schistosomiasis*. The snails controlled *Ceratophyllum demersum*, *Najas quadalupensis*, and *Potamogeton illinoensis* completely and *Pistia stratiotes* and *Alternanthera philoxeroides* partially. *Eichhornia crassipes* was not completely eaten, but its growth and flowering were greatly retarded by the root-pruning action of the snails.

Marisa preferred submersed weeds to floating or emersed weeds, but the floating weed *Salvinia rotundifolia* was eaten nearly as readily as submersed weeds. Little damage was done by *Marisa* to 4- and 5-week-old rice plants, but younger rice was killed when the snails had no other source of food.

4722. Selby, W. E. TERRACE SYSTEM MAINTENANCE. Kans. State U. Agr. Ext. Engin. Balanced Farming Land Reclam. 6, 6 pp. May 1964. 275.29 K13EnL

An illustrated report was given on terrace maintenance in Kansas.

4723. Sepp, M. STABILIZATION OF SLOPES OF DRAINAGE CANALS BY PLANTING GRASS MIXTURES. (Es) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov 25: 85-93. Ref. 1963. 106 Es83 German summary.

4724. Shallock, D. A. WEED CONTROL IN DRAINAGE AND IRRIGATION DITCHES AROUND BOGS. Amer. Cranberry Growers' Assoc. Proc. Annu. Mtg. 89: 7-11. 1959. 81 Am35M

A report was given on chemical weed control in drainage and irrigation ditches in cranberry bogs in New Jersey. Dalapon, sodium arsenite, and 2,4-D recommendations were given. The use of sodium arsenite was not recommended for areas where fish were involved or where the drainage waters empty into a reservoir that contains fish.

4725. Shearer, M. N. CONTROLLING SEEPAGE IN HOLDING PONDS CONSTRUCTED OF POROUS MATERIAL. Mich. Agr. Expt. Sta. Dept. Resource Devlpmt. Water Res. Rpt. 1, 11 pp. 1961? 292.9 M583

A report was given on controlling seepage in holding ponds constructed of porous materials in Michigan. The following techniques were discussed: (1) Reducing size of interstitial openings by compression, bentonite dispersion, and SS-13; and (2) lining of the porous areas by earth linings, concrete, polyethylene, vinyl plascic, and asphalt-coated jute.

4726. Shell, E. W. CONTROL OF AQUATIC WEEDS WITH FISH. Ala. Highlights Agr. Res. 11(2): 16. 1964. 100 AL1H

To combat weeds in ponds, the owner has a choice of using chemicals (herbicides), cutting mechanically, controlling by fertilization, or combining these methods. However, there are disadvantages associated with any one of them. Experiments were reported on the use of the Israeli strain of common minnow carp and three species of tropical tilapia to control aquatic weeds.

All species of fish tested were effective in eliminating aquatic weeds from ponds containing only those species. However, when stocked in ponds containing established populations of largemouth bass and bluegills at rates that did not interfere with population balance, the effectiveness of the herbivorous fish was somewhat reduced.

4727. Shen, R. T. SEALING SANDY DITCHES WITH THE BENTONITE DISPERSION METHOD. Wyo. Agr. Col. Ext. C. 158, 9 pp. Apr. 1959. 275.29 W99C

An illustrated report was given on the use of the bentonite dispersion method to seal sandy ditches in Wyoming.

4728. Shen, R. T. SEALING ROCKY DITCHES WITH THE BENTONITE MULTIPLE-DAM METHOD. Wyo. Agr. Col. Ext. C. 159, 9 pp. Apr. 1959. 275.29 W99C

An illustrated report was given on the use of the bentonite multiple-dam method to seal rocky ditches in Wyoming.

4729. Shen, R. T. SEALING SANDY DITCHES WITH THE BENTONITE DISPERSION METHOD. Colo. State U. Ext. C. 202-A, 9 pp. Apr. 1959. 275.29 C71Ci

An illustrated circular was given on the bentonite dispersion method of sealing sandy ditches in Colorado.

4730. Shen, R. T. SEALING ROCKY DITCHES WITH THE BENTONITE MULTIPLE-DAM METHOD. Colo. State U. Ext. C. 203-A, 9 pp. Apr. 1959. 275.29 C71Ci

An illustrated circular was given on the use of the bentonite multiple-dam method of sealing rocky ditches in Colorado.

4731. Shen, R. T. MIXING BENTONITE FOR SEALING PURPOSES. Colo. State U. Ext. C. 204-A, 9 pp. Apr. 1959. 275.29 C71Ci

An illustrated circular was given on mixing bentonite for sealing irrigation ditches in Colorado.

4732. Shen, R. T. MIXING BENTONITE FOR SEALING PURPOSES. Wyo. Agr. Col. Ext. C. 160, 9 pp. May 1959. 275.29 W99C

An illustrated method was given on methods to mix bentonite for seepage control of ditches and ponds in Wyoming.

4733. Shen, R. T. TESTING BENTONITE FOR SEALING PURPOSES. Colo. State U. Ext. C. 205-A, 9 pp. Aug. 1959. 275.29 C71Ci

An illustrated circular was given on methods used to test bentonite for sealing purposes in Colorado.

4734. Sherwood, F. G. LAND FROM THE SEA: RECLAMATION OF TIDAL MUDFLATS IN HOKIANGA COUNTY. New Zeal. J. Agr. 107(2): 122-125, 128-129, map. Aug. 15, 1963. 23 N48J

A report was given on the reclamation of tidal mudflats in New Zealand by dikes and internal drains.

4735. Shipley, H. MAINTENANCE. Reclam. Era 42: 67-68. Aug. 1956. 156.84 R24

A report on the maintenance of irrigation canals and ditches was given that included weed control and seepage control.

4736. Shrag, V. I. IMPERVIOUS LININGS IN SUBSURFACE SOILS. (Rus) Pochvovedenie 1958(7): 1-11. Ref. July. 57.8 P34
English summary. English trans. Soviet Soil Sci. 7: 707-715. July 1958. 57.8 P34Ae

The use of concrete screen 4-5 mm. thick at a depth of 0.2-0.4 m. was proposed to reduce seepage losses from irrigation canals.

4737. Shubladze, K. MECHANIZATION OF EXCLAVATION IN WATER DEVELOPMENT IN THE U.S.S.R. Internatl. Comn. Irrig. and Drain. Annu. B. 1956: 36-37. 1956. 55.9 IN8A

A report was given on the construction and maintenance (silt removal) of irrigation and drainage canals in the U.S.S.R.

4738. Simmons, O. E. CANAL SEEPAGE; ITS CAUSE AND TREATMENT IN PALOVERDE IRRIGATION DISTRICT. Natl. Reclam. Assoc. Proc. 26: 49-52. 1957. 55.9 N212

A report was given on canal seepage in the Palo Verde Irrigation District of California.

The irrigation district helps pay 1/2 the cost of placing drain tile parallel to the canal to intercept seepage. The drain tile have proved effective but few have been installed by the farmers.

The use of Holtville clay as a sealing agent for the canal has also been successful in the areas treated.

4739. Skovborg, H. PLANTING "GRASS THAT DOES NOT NEED CUTTING" ON SLOPES OF CANALS AND DITCHES. (Da) Hedeselsk. Tidsskr. 83(3): 61-64. Mar. 10, 1962. 11 H35

4740. Slob, W. A DITCH CLEANING DEMONSTRATION. (Du) Nederland. Heidemaatsch. Tijdschr. 71 (12): 328-331. Dec. 1960. 12 N282

4741. Smirnov, A. V. ON THE PROBLEM OF THE RECONSTRUCTION OF DRAINAGE SYSTEMS. (Rus) Gidrotekh. i Melior. 4: 24-29. Apr. 1963. 290.8 G362

4742. Smirnov, A. V., and Nefedov, V. D. RECONSTRUCTION OF THE DRAINAGE SYSTEMS. (Rus) Moska, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury, 1957. 109 pp. 1957. 54 Sm4P

4743. Smit, A. THE HIGH PRESSURE DRAINAGE DITCH CLEANER. (Du) Nederland. Heidemaatsch. Tijdschr. 72(7/8): 159-164. July/Aug. 1961. 12 N282

4744. Smit, J. A. P. EQUIPMENT FOR CLEANING TRENCHES AND DITCHES. (Du) Wageningen. Inst. v. Landbtech. en Ration. P. 39, 34 pp. Aug. 1957. 58.9 W12

4745. Smith, C. N. INSTALLING PLASTIC LINING IN MCCASKEY LATERAL. Reclam. Era 48(4): 95-97. Nov. 1962. 156.84 R24

A report was given on the installation of a buried plastic liner on the McCaskey drainage lateral in New Mexico.

4746. Smith, D. D. MAINTAIN TERRACE WITH PLOW. Hoard's Dairyman 102(10): 534-535. 1957. 44.8 H65

A discussion was given on the maintenance of terraces with the plow.

4747. Struckman, H. J. UPLAND DRAINAGE BY THE STREAM CLEARANCE PROGRAM AND BENEFITS DERIVED FROM MOSQUITO CONTROL. N. J. Mosquito Extermin. Assoc. Proc. 45: 118-120. 1958. 420 N46

A report was given on the drainage and the equipment used to help control mosquitoes in New Jersey.

4748. Stryjewski, F. SCHEME FOR INSTRUCTION FOR THE RENOVATION OF PIPE DRAINAGE SYSTEMS. 11 pp. (OTS 61-31308) Transl. 13386
Translation from Wiadomosci Instytutu Melioracji i Uzytkow Zielonych 1: 137-148. 1958.

A report was given of the economics of repairing or replacing pipe drainage systems in Poland when the drainage system is not working correctly. Methods used to repair and maintain pipe systems were reported.

4749. Sudhoff, H., and Hugenberg, G. MECHANICAL-CHEMICAL DITCH CLEANING. (Ge) Wasser u. Boden 13(1): 12-14. Jan. 1961. 56.8 W28

4750. Suggs, D. D. WEED CONTROL IN IRRIGATION AND DRAINAGE SYSTEMS. Oreg. Weed Conf. Proc., Annu. Conf. 12: 41. 1963. 79.9 Or3

A report was given on mechanical and chemical weed control in irrigation and drainage system in the Columbia Basin in Oregon.

4751. Suladze, I. D. THE APPLICATION OF PREFABRICATED REINFORCED CONCRETE FLUMES IN IRRIGATION CONSTRUCTION. (Rus) Gidrotekh. i Melior. 1960(7): 13-22. July 1960. 290.8 G362

4752. Sutton, J. G. OUTLET DITCHES, SLOPES, BANKS, DIKES, AND LEVEES. U. S. Dept. Agr., Agr. Ybk. 1955: 521-528. 1955. 1 Ag84Y

The need, installation, and maintenance of outlet ditches, side slopes, banks, levees, and dikes were discussed.

4753. Sweet, C. L. WILL CHEMISTRY REDUCE SEEPAGE LOSSES? Reclam. Era 45(4): 90-91. Nov. 1959. 156.84 R24

A report was given on the use of the soil sealant "SS-13" for seepage control in irrigation canals.

4754. Swift, A. CONTINUOUS MAINTENANCE OF DRAINAGE SYSTEMS. (No) Ny Jord 51(1): 6-12, map. Feb. 1964. 282.28 N98

4755. Teipel, R. MAINTENANCE OPERATION OF DRAINAGE EQUIPMENT. (Ge) Deut. Landwirt. 13(3): 148-152. Ref. Mar. 1962. 18 D4822

4756. Teipel, R. SUGGESTIONS FOR AMELIORATION DURING SPRING 1963. U. S. Joint P. Res. Serv. Transl. East European Agr. Forestry & Food Indus. 176: 17-20. June 26, 1963. 173 J663 Ste.
Translation from Wasserwirtschaft-Wassertechnik 2: 61. Apr. 1963.

Suggestions were given on drainage and irrigation jobs and maintenance to do in Germany in the spring.

4757. Teipel, R. STATUS OF MECHANIZED DITCH CLEANING IN THE GERMAN DEMOCRATIC REPUBLIC. (Ge) Deut. Agrartech. 14(1): 21-24. Jan. 1964. 58.8 D482

4758. Teipel, R. SITUATION OF MECHANIZED DITCH CLEANING IN THE DDR. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 5(2): 82-85. Feb. 1964. 18 W763

4759. Theobald, G. H. RECONDITIONING OF OLD DRAINS. Inst. Brit. Agr. Engin. J. 14(1): 24-31. Jan. 1958. 58.9 In7

4760. Thomsen, K. OUR WESTERN DIKES DEFY THE SHINING HANS. (Ge) Schleswig-Holstein 14(8): 208-210. Aug. 1962. 110 Sch3

4761. Timmons, F. L., Bruns, V. F., Lee, W. O., Yeo, R. R., Hodgson, J. M., Weldon, L. W., and Comes, R. D. STUDIES ON THE CONTROL OF COMMON CATTAIL IN DRAINAGE CHANNELS AND DITCHES. U. S. Dept. Agr., Agr. Res. Serv. Tech. B. 1286, 51 pp. 1963. 1 Ag84Te

Common cattail is an economically important weed in drainage and irrigation canals, farm ponds, reservoirs, marshes, and the margins of lakes. Life history and control studies were reported for the Pacific Northwest.

4762. Timmons, F. L., and Klingman, D. L. CONTROL OF AQUATIC AND BANK VEGETATION AND PHREATOPHYTES. Water and Agr., Amer. Assoc. for Advancement of Sci. P. 62: 157-170. 1960. 292.9 Am33

Aquatic weeds, bank weeds, and phreatophytes are causing tremendous losses to American agriculture every year. Aquatic weeds grow submersed in, floating on, or emergent from the water in irrigation and drain canals, in reservoirs, and in farm ponds. Bank weeds grow at the waterline or immediately above with their roots extending into the saturated or moist soil. Phreatophytes grow along streams, canals, or reservoirs, and on river floodplains and habitually obtain their water supply from the groundwater table (zone of saturation) or the capillary fringe above.

The traditional methods of controlling aquatic and bank weeds include handcutting or pulling and mechanical mowing, chaining, dragging, or crushing. These methods are still in use in many areas and in many situations but, with the present high labor costs and extensive weed infestations, they are too slow and expensive for extensive use. In most instances the hand and mechanical methods give only partial or temporary control.

New and improved methods of controlling phreatophytes (trees and shrubs) and aquatic and bank weeds were reported.

4763. Timofeev, A. F. ON CARE OF DRAINAGE SYSTEMS [IN FORESTS]. (Rus) Lesn. Khoz. 9(5): 26-28. May 1956. 99.8 L5622

4764. Tolman, N. SOIL STERILENT CONTROL OF WEEDS. Irrig. Engin. and Maintenance 8(12): 9, 26-27. 1958. 55.8 Ir722

Men who operate irrigation systems in the higher rainfall belts of the more humid states generally agree that grass-type weeds are one of their more troublesome operation problems.

For the last 3 1/2 years, a soil sterilent (CMU) has been tested at Nebraska for control of grass weeds. Spring application has proven to be the most satisfactory in this area. Sterilent should be applied to a freshly cleaned or burned lateral as soon as the frost is out of the ground in the spring. The results are poor if sterilent is applied to frozen ground or laterals filled with trash and debris. Fall application seems to require about one-third more chemical to get the same results.

The use of 10(clay soils) to 15 pounds (sandy soils) of the sterilent per acre, gave good control of grass weeds. The sterilent should be applied with a rather low quantity of water; one pound to four or five gallons of water makes a satisfactory mix.

4765. Toohey, C. L. A USEFUL DRAIN CLEANER. Queensland Bur. Sugar Expt. Sta. Cane Growers' Q. B. 26(4): 113-114. Apr. 1, 1963. 65.9 Q3C

A report was given of a drain cleaner used in Australia to construct and clean drainage and irrigation ditches for sugarcane production.

4766. Tramdahs, A. STABILITY OF WATER CARRYING DRAINAGE CANALS. (La) Riga, Latvijas Valsts izdevnieciba, 149 pp. 1961. 54 T68

4767. Tsarevskii, A. M., Pugavko, B. I., and Fomenko, V. N. SUCTION DREDGES EQUIPPED WITH NEW OPERATING ASSEMBLY. (Rus) Gidrotekh. i Melior. 1961(2): 51-56. Feb. 1961. 290.8 G362

4768. Tseng, R. H. RECLAMATION OF TIDAL LAND FOR SUGARCANE PLANTATION. Taiwan Sugar 11(3): 24-28, map. July/Sept. 1964. 65.8 T133

A report was given on the reclamation of tidal land in Taiwan for sugarcane production.

4769. Tuinstra, U. THE OLD DIKES IN FRIESLAND AND GRONINGEN. (Du) Nederland Heidemaatsch. Tijdschr. 66: 128-131. May 1955. 12 N282

4770. Turks, V. A. MECHANIZED CLEANING OF THE MAIN PART OF AN IRRIGATION CANAL. (Rus) Gidrotekh. i Melior. 10(2): 44-49. Feb. 1957. 290.8 G362

4771. Turnbull, W. J., and Foster, C. R. STABILIZATION OF MATERIALS BY COMPACTION. Amer. Soc. Cival. Engin. Trans. 123: 1-15. 1958. 290.9 Am3

A soil can often be stabilized by compaction at the proper water content. The relationship was shown between strength and both water content and density for cohesive soils, and the variations in the density and strength produced by variations in rolling and lift thicknesses in field compaction were described.

With discussion by Messrs. Gerald A. Leonards; John A. Focht, Jr; Edmund J. Zegarra; Kazuo B. Hirashima; and Willard J. Turnbull and Charles R. Foster, pp 16-26.

4772. Turnbull, W. J., and Mansur, C. I. CONSTRUCTION AND MAINTENANCE OF CONTROL MEASURES. Amer. Soc. Cival Engin. Trans. 126(1): 1540-1568. 1961. 290.9 Am3

A summary of basic principles involved in the construction and maintenance of various underseepage control measures was presented together with an appendix describing a field study of a system of relief wells installed along a reach of levee along the Mississippi River.

Workmanlike construction adequately meeting design requirements as well as proper and timely maintenance are of prime importance in the success of any type of underseepage control measure.

4773. U. S. Agricultural Research Service. SELECTIVE APPETITE IS PUT TO WORK AS--SNAILS WEED WATERWAYS. Agr. Res. 11(3): 8-9. 1962. 1.98 Ag84

The snail (Marisa cornuarietis L.) was tested as a control of several aquatic weeds that impede southern U. S. waterways. The results were encouraging.

The snail made a clean sweep of four weeds--coontail, southern naiad, Illinois pondweed, and salvinia. All are troublesome in canals, ponds, and lakes. The snail inhibited growth and flowering of water-hyacinth and partially controlled alligatorweed--which are among the worst aquatic weeds in the United States. It partially controlled waterlettuce and fed readily on fanwort and filamentous algae.

In limited tests, 3- and 4-week-old rice plants syffered vert kuttke damage, even though the snails had no other source of food. But younger transplants and germinating rice seeds did not survive. In previous tests, the snails destroyed rice seedlings grown from direct field planting of seed--commonly used in the United States--but did little damage to older transplants.

4774. U. S. Agricultural Research Service. UNDERGROUND PRIVATE EYE. Agr. Res. 11(5): 8-9. 1962. 1 Ag84J

A self-propelled "private eye" can inch its way through an underground drainage line in a farmer's field and record what it sees. The device is a camera with remote control, built as a research tool to locate damaged or clogged tiles.

The camera should prove useful to farmers in finding clogged spots in their drainage systems. With photographs from the self-propelled camera, scientists can inspect a much greater length of drainage line than is possible when a random tile is excavated and examined. They can insert the camera at the drainage outlet or at any point along a line where tile is exposed by excavation.

4775. U. S. Agricultural Research Service. CHEMICAL CONTROL OF SUBMERSED WATERWEEDS IN WESTERN IRRIGATION AND DRAINAGE CANALS. U. S. Dept. Agr., Agr. Res. Serv. ARS-34-57, 14 pp. Oct. 1963. A64.9 R31A.

A detailed report was given on the chemical control of waterweeds in irrigation and drainage canals in the Western States.

4776. U. S. Bureau of Reclamation. LININGS FOR IRRIGATION CANALS, INCLUDING A PROGRESS REPORT ON THE LOWER COST CANAL LINING PROGRAM. Washington, 149 pp. 1963. 156.85 L642

Instructions, standards, and procedures developed by the Bureau of Reclamation were given for use in the lining of irrigation canals. An economic analysis and evaluation of the relative merit of lining or not lining were given. Information on the principal types of canal lining and their design, costs, methods of placement, uses, and serviceability were given.

4777. U. S. Soil Conservation Service. REPORT ON AN EVALUATION OF TILE DRAINS LAID WITH ORGANIC BLINDING MATERIALS: Skagit S.C.D., Washington. Portland, Oreg. 11 pp. 1959. A54 So33

A report was given on the evaluation of tile drains laid with organic blinding material in Skagit County, Wash.

4778. Uotila, P. J. CLEANING OPEN DITCHES BY USING A LIGHT DITCH PLOUGH. (Fin) Teho 1956(11): 578-580. 1956. 20 T98
English summary, p. 620.

The use of a light ditching plow with a relatively small power plant was described that has proven successful for drainage ditch maintenance in Finland.

4779. Urena, R. De. EL CANAL DE MONEGROS--ITS CONSERVATION AND EXPLOITATION IN GYPSEOUS SOIL. (Fr) Cong. Irrig. & Drain. Trans. 4(6): C.239-C.255, maps. 1960. 55.9 C7652

A report was given on the damage to irrigation canals on gypseous soils in Spain. Different methods used to repair the canals were dismissed.

4780. Usov, A. S. USE OF POLYETHYLENE FILMS FOR CONSTRUCTION OF CANALS IN GOLODNAYA STEPPE. (Rus) Gidrotekh. i Melior. 6: 53-55. June 1964. 290.8 G362

4781. Valiron, F. CANAL LINING PROBLEMS DUE TO THE NATURE OF THE GROUND. (Fr) Cong. Irrig. & Drain. Trans. 3(2): 7.121-7.132. 1957. 55.9 C7652

The problems of construction of large irrigation canals in northern Tunisia were discussed.

4782. Van Asbeck, W. F. ASPHALT IRRIGATION CANAL LININGS. Cong. Irrig. & Drainage Trans. 3(2): 7.1-7.16. 1957. 55.9 C7652

A report was given on the use of buried asphalt membrane lining of irrigation canals where waterproofing is the only purpose of the lining and of hot-mix asphalt lining where a smooth strong surface is also required in order to permit a better flow of water. Examples were mentioned of these types of lining used in Pakistan, Morocco, and Egypt.

4783. Vannote, R. L. BENEFITS DERIVED FROM WATERCOURSE CLEARANCE IN MORRIS COUNTY. N. J. Mosquito Extermin. Assoc. Proc. 45: 120-122. 1958. 420 N46

A report was given on the benefits derived from mosquito control with stream clearance to improve drainage in New Jersey.

4784. Van Straaten, N. J. KEEP CONTOUR BANKS AND CHANNELS IN GOOD REPAIR. Farming So. Africa 39(7): 56-60, 62. Oct. 1963. 24 So842

A discussion was given on the upkeep and repair of contour banks (terraces) in South Africa.

4785. Vardzelashvili, M. G. SOIL MANAGEMENT ON TERRACES. (Rus) Sadovodstvo 1962(3): 15-16. Mar. 1962. 80 Sa13

4786. Vedenyapin, V. V. USE OF POLYETHYLENE FILM FOR REDUCTION OF FILTRATION LOSSES OF WATER IN IRRIGATION CANALS. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 82: 64-70. 1962. 20 M857

4787. Veen, E. T. USE OF MACHINES IN REPAIR AND MAINTENANCE OF SMALLER WATER COURSES. (Ge) Allg. Forstz. 14(41): 731-734. Oct. 10, 1959. 99.8 AL52

4788. Velev, D., Strahilov, E., and Kochev, K. LINING OF SMALL IRRIGATION CHANNELS WITH ASBESTOS CEMENT FLUMES. Cong. Irrig. & Drain. Trans. 4(6): C.313-C.326. 1960. 55.9 C7652

A report was given on the use of asbestos cement flumes in Bulgaria to line small irrigation canals.

4789. Volkovskii, P. A. MAINTENANCE OF DRAINAGE CANALS. (Rus) Moskov. Ordena Lenina Sel' skokhoz. Akad. im. K. A. Timiriazeva. Dok. 87: 211-216. 1963. 20 M857

4790. Walkowiak, H. DESTRUCTION OF UNWANTED PLANT GROWTH IN DRAINAGE DITCHES ON A LOW MOOR SITE WITH THE HELP OF HERBICIDES. (Ge) Z. f. Landeskult. 4(3/4): 253-276. Ref. 1963. 282.9 Z3
English summary.

A report was given on the effectiveness of several herbicides tested for destroying undesirable plant growth in drainage ditches in East Germany.
The author concluded that chemical weed control had a substantial place in helping manual weeding or machinery weeding for ditches that dry out temporarily.

4791. Watanabe, H. THE RESULTS OF THE USE OF PLASTICS IN RICE PADDY CONSTRUCTION. (Ja) Nogyo Gumma 42(3): 114-117. Mar. 1964. 22.5 N6898

4792. Watanabe, I. RICE LEVEE COATING BY USING A LEVEE SHEET. (Ja) Fumin 35(6): 74-75. June 1963. 22.5 F962

4793. Weij, H. G., Van Der, and Rozenboom, G. CHEMICAL WEED CONTROL IN THE MAINTENANCE OF DITCHES. (Du) Wageningen. Inst. v. Biol. en Schelk. Onderz. van Landbgewassen. Meded. 71/90: 65-71. 1959. 60.9 W123
English summary.

A report was given on the use of chemical weed control measures for the maintenance of ditches in the Netherlands.

4794. Weldon, L. W., Blackburn, R. D., and Seaman, D. E. RECENT ADVANCES IN AQUATIC WEED CONTROL. Soil & Crop Sci. Soc. Fla. Proc. 21: 107-114. Ref. 1961, pub. 1962. 56.9 So32

A report was given on recent advances in aquatic weed control.

4795. Wickline, E. V. COMMON CHEMICAL HELPS SEAL LEAKY PONDS. J. Soil and Water Conserv. 13: 128-129. 1958. 56.8 J822

Twenty-five farm ponds, in the limestone area in Greenbrier County in West Virginia, that were complete failures due to excess seepage, are now holding water satisfactorily as a result of a new chemical treatment of the soil inside the reservoir. Since none of the treated ponds is much more than a year old, it is not known how permanent a seal has been obtained. The results to date appear to justify continued use of the process. The chemical is sodium tripolyphosphate widely used in household detergents. The ponds treated range in size from 1/20 of an acre to 1/4 acre.
Including the cost of machinery, materials, and labor the job can easily be done on the average farm pond for less than 1¢ per square foot.
Sodium tripolyphosphate mixed with moist soil and compacted causes the soil to lose its granular structure and become more dense.

4796. Wiedemann, W. CHEMICAL WEED CONTROL OF DITCHES FROM WATER RIGHTS ASPECT. (Ge) Wasser u. Boden 13(5): 162. May 1961. 56.8 W28

4797. Wiese, J. BENTONITE POND LINING SOLVES WATER PROBLEM. Soil Conserv. 28(9): 215-216. May 1963. 1.6 So3S

A report was given on the use of bentonite linings for stockwater ponds in Wyoming to obtain better grazing distribution and grass improvement.

4798. Wijk, A. Van. DITCH CLEANERS. (Du) Landbouwmechanisatie 8(12): 570-575. Dec. 1957. 58.8 L2352

4799. Wijk, A. Van. MECHANICAL CLEANING OF DITCHES. (Du) Landbk. Tijdschr. 70(7/8): 589-598. July/Aug. 1958. 105.2 Or3

4800. Wijk, A. Van. EQUIPMENT FOR THE CLEANING OF DITCHES. (Du) CMC Melk 14(20): 324-327. Jan. 31, 1959. 44.8 C11

4801. Wijk, A. Van. NEW EQUIPMENT FOR MOWING OF SLOPES AND CLEANING DITCHES. (Du) Landbouwmechanisatie 11(11): 715-722. Nov. 1960. 58.8 L2352

4802. Wijk, A. Van. REPORT OF THE NATIONAL DEMONSTRATION OF DITCH CLEANING EQUIPMENT AT ZUIDLAARDERVEEN ON OCTOBER 21, 1960. (Du) Wageningen Inst. v. Landbtech. en Ration. Gestencilde Meded. 5, 19 pp. 1961. 58.9 W12G

4803. Wijk, A. Van. EQUIPMENT FOR CLEANING DITCHES. (Du) Landbouwmechanisatie 13(10): 853-862.

4804. Wijk, A. Van. NEW MACHINES PRESENTED AT THE DITCH CLEANING DEMONSTRATION AT GRIENDTSVEEN. (Du) Landbouwmechanisatie 14(11): 909-916. Nov. 1963. 58.8 L2352
English summary.

New machinery presented at a ditch cleaning demonstration in the Netherlands for the maintenance of water courses and ditches were described and illustrated.

4805. Wijk, A. Van. DITCH CLEANERS. (Du) Landbouwmechanisatie 15(10): 953-959, 961, 963-967. Oct. 1964. 58.8 L2352
English summary.

Various types of mechanized ditch cleaners used in the Netherlands were described and illustrated.

4806. Wilder, C. L. CONCRETE PIPE AND CANAL LININGS. Irrig. Engin. & Maintenance 7(3): 17, 27-28. Mar. 1957. 55.8 Ir722

The use of concrete pipe and concrete canal linings for irrigation water was explained.
The principal reasons for lining irrigation canals are: (1) Seepage is prevented; (2) maintenance cost is reduced; (3) operating waste is greatly reduced; (4) operating the system is easier and more economical; and (5) the weed problem is greatly reduced.
The principal reasons for the use of an underground pipeline in place of a surface canal for irrigation are: (1) Evaporation is reduced; (2) the weed and insect problem is eliminated; (3) no right of way is required for the buried pipeline and farming operations continue as if it is not there; and (4) pipeline can be designed and built to operate under pressure.

4807. Wilder, C. R. CONCRETE CANAL LININGS FOR CONTROL OF SEEPAGE. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 104-112. Ref. Jan. 1965. A56.9 R31

A report was given on the use of concrete canal liners for the control of seepage.

4808. Williams, T. T., and Peterson, D. F. ECONOMICAL DROP STRUCTURES HALT CANAL EROSION. Reclam. Era 45(2): 30-32. May 1959. 156.84 R24

Economical drop structures to halt erosion in irrigation canals were described and illustrated.

4809. Willson, R. J. LOWER-COST CANAL LINING PRACTICE. Amer. Soc. Civil Engin. Trans. 125: 487-514. 1960. 290.9 Am3

Seepage through canals and laterals, that causes loss of valuable water and water-logging of valuable farm lands, is an important problem that can best be dealt with by some manner of canal lining. The various types of linings available were examined. The commonly used types of canal linings were described and their respective advantages, disadvantages, and limitations were enumerated. Experimental linings, whose usefulness is still being considered, and more recent developments that are thought to be of significant interest to the field, were described.
With discussion by Messrs. Frederick L. Hotes; and Richard J. Willson, pp. 515-516.

4810. Willson, R. J. BUREAU OF RECLAMATION PROGRESS IN CONSTRUCTION OF LOWER COST CANAL LININGS. Internatl. Comn. Irrig. & Drain. Annu. B. 1961: 23-28, 46. 1961. 55.9 In8A

A report was given on the Bureau of Reclamation's progress in construction of lower cost canal linings during a 15-year period. The various types of lining tested and recommended were given.

4811. Willson, R. J. CHEMICAL SEALANTS AND CANAL SEEPAGE. Trans. ASAE 7(1): 56-60, 66. 1964. 290.9 Am32T

A discussion was given on the use of chemical sealants to control canal seepage. In the tests to date, all sealants appeared to be more effective in sandy soils.

4812. Willson, R. J. A LOWER COST CANAL LINING PROGRAM. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 85-93. Jan. 1965. A56.9 R31
Discussion, pp. 97-99.

A report was given on the lower cost canal lining program conducted by the Bureau of Reclamation. The quantities of canal linings placed on Bureau projects were listed along with some construction costs of various canal linings.

4813. Wilson, R. A PROGRESS REPORT ON THE USE OF HERBICIDES IN ESSEX COUNTY. N. J. Mosquito Extermin. Assoc. Proc. 45: 165-168. 1958. 420 N46

A progress report was given on the value of weed control in drainage ditches to improve drainage and reduce mosquitoes in New Jersey.

4814. Wineland, J. A., and Lucas, C. V. ECONOMIC COMPARISONS OF CANAL LININGS FOR THE CALIFORNIA AQUEDUCT. In PROCEEDINGS SEEPAGE SYMPOSIUM, PHOENIX, ARIZONA, 1963. U. S. Dept. Agr., Agr. Res. Serv. ARS-41-90: 38-46. Jan. 1965. A56.9 R31

A report and discussion were given on the economic comparison of compacted earth linings, concrete linings, and concrete lining plus sublinings for canal linings for the California aqueduct.

4815. Wouters. DRAINAGE AND UPKEEP OF WATER COURTS IN GERMANY. (Ge) Chambres d'Agr. 27(93, Tech. Agr.): 14-16. Feb. 1, 1956. 14 T69

4816. Yamaguchi, E., Oka, A., Nanba, N., and Muraoka, Y. EARTHING-UP OF LEVEE ON POLDER LANDS OF SAGA PREFECTURE. (Ja) Kyushu Agr. Res. 20: 127-128. Mar. 1958. 107.6 K996

4817. Yevnin, A., and Bernstein, G. LOW COST METHODS OF SEEPAGE REDUCTION AND WATER HARVESTING: SURVEY OF PUBLICATIONS, 1957-63. Water Planning For Israel. P. N. 407, 18 pp. Jan. 1964. 292 Y4

A review of the literature was given on articles on low cost methods of seepage reduction and water harvesting for the period 1957-1963.

4818. Zaleski, M. THE ECONOMICAL EFFECTS OF THE USE OF "LINCOL" MACHINE FOR CLEANING THE DRAINAGE DITCHES AND DIKES. (Po) Warsaw Szkoła Główna Gosp. Wiejsk. Ekon. i Organ. Roln. 3: 243-252. 1960. 281.9 W26
English summary.

4819. Zarzycki, J. "WATER PARTNERSHIPS" IN THE LIGHT OF THE NEW WATER LAW. (Po) Nowe Roln. 11 (22): 43-44. Nov. 15, 1962. 20.5 N86

4820. Zherebtsov, V. V., and Zaidman, Y. D. RESULTS OF TESTING SOIL COMPACTING MACHINERY. (Rus) Gidrotekh. i Melior. 1961(6): 42-46. June 1961. 290.8 G362

4821. Zierold Reyes, L. EARTH CANALS AND RECOVERED CANALS. (Sp) Ingen. Hidraul. en Mex. 18 (1/2): 112-121. Jan./June 1964. 290.8 In43

SEE ALSO--45, 106, 123, 403, 509, 610, 934-936, 978, 1124, 1163, 1164, 1232, 1266, 1269, 1284, 1312, 1336, 1342, 1381, 1391, 1420, 1424, 1445, 1475, 1482, 1503, 1511-1515, 1527, 1529, 1530, 1531, 1537, 1540, 1545, 1554, 1564, 1567, 1569, 1574, 1575, 1581-1584, 1589, 1590, 1592-1596, 1600, 1604, 1621, 1634, 1635, 1641, 1660, 1670, 1702, 1727, 1729, 1734, 1737, 1758, 1760, 1764, 1765, 1788b, 1799, 1800, 1808, 1815, 1829, 1834, 1848, 1864, 1885, 1908-1911, 1915, 1942, 1943, 1969, 1984, 1989-2001, 2007, 2015, 2027, 2039, 2040, 2045, 2071, 2072, 2096, 2098, 2114, 2120, 2121, 2125, 2151, 2186, 2189, 2190, 2199, 2201, 2204, 2205, 2227, 2244, 2245, 2255, 2257, 2258, 2265, 2270, 2271, 2286, 2295, 2304, 2306, 2313, 2330, 2331, 2335, 2346, 2352, 2388, 2418, 2435, 2494, 2558, 2613, 2707, 2896, 2972, 3006, 3074, 3078, 3089, 3097, 3115, 3124, 3127, 3191, 3197, 3215, 3217, 3223, 3232, 3261, 3276, 3281, 3289, 3291, 3311, 3313, 3315, 3317, 3319, 3342, 3343, 3345, 3355, 3357, 3359, 3378, 3380, 3389, 3391, 3395, 3400, 3407, 3414, 3417, 3420, 3422, 3440, 3441, 3446, 3449, 3451, 3456, 3459, 3464, 3466, 3467, 3471, 3476, 3479, 3481, 3485, 3486, 3495, 3500, 3505, 3511, 3512, 3560, 3573, 3577, 3595, 3622, 3654, 3666, 3689, 3709, 3728, 3733, 3749, 3758, 3763, 3778, 3784, 3790, 3814, 3820, 3862, 3888, 3890, 3899, 3915, 3929, 3932, 3940, 3951, 3991, 4028, 4042, 4072, 4086, 4090, 4094-4096, 4101, 4109-4113, 4116, 4129, 4137, 4141, 4144, 4146-4148, 4150, 4155, 4157, 4159, 4166, 4173, 4191-4193, 4208, 4210, 4212, 4225, 4230, 4233, 4234, 4242, 4249, 4251-4253, 4257, 4260, 4263, 4266, 4278, 4281, 4289, 4294, 4297, 4314, 4316, 4317, 4320-4322, 4325-4327, 4335, 4336, 4343, 4344, 4346, 4349, 4358, 4363, 4365, 4367, 4368, 4379-4382, 4385, 4387, 4392-4394, 4396, 4397, 4399, 4404, 4411, 4419, 4439, 4440, 4447, 4450, 4452-4457, 4460, 4461, 4468, 4854, 4903, 4921, 4968, 4976, 5005, 5020, 5061, 5063, 5071, 5083, 5087, 5089.

SPECIAL PROBLEMS

Organic Soil Drainage

4822. Afanas'ev, G. RECLAMATION OF PEAT BOGS IN ARCHANGEL REGION. (Rus) Sel'sk. Khoz. Sev.-Zapadnoi Zony 1961(5): 71-73. May 1961. 20 Se497

4823. Afanas'ev, G. V., Danilov, I. Y., and Kashanskii, A. D. RECLAMATION OF PEAT SOILS IN THE NORTHERN PART OF THE ARCHANGEL REGION. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 60: 103-110. 1961. 20 M857

4824. Agerberg, L. S. REVIEW OF THE ACTIVITIES OF THE SWEDISH ASSOCIATION FOR MARSHLAND CULTURE AND SOME OBSERVATIONS ON THE NEED FOR CONTINUED ACTIVITIES IN THE MARSHLAND CULTURE FIELD. (Sw) (Sum.) Beten-Vallar-Mossar 13(3): 34-36. Apr. 1961. 11 B46

4825. Alekeevs'kii, E. F., ed. TRANSFORMATION OF BOGS INTO FERTILE LANDS. (Rus) Kylv, Derzhavne Vydavnytztvo Sil'skohospodarskoyi Literatury Ukrains' koi RSR, 230 pp. 1960. 54 AL22

4826. Alfnes, A. FROM ACID MARSH TO PRODUCTIVE FIELD. (No) Norsk Landbr. 20: 596-597. Sept. 1960. 11 N8122

4827. Anderson, M. A., and Bergman, I. I. METHODS OF UTILIZATION OF PEAT BOGS IN LATVIA SSR. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHEMYKH POCHV, 1955. Trudy, pp. 286-297. Minsk, 1956. 54.9 K83

4828. Aver'ianov, S. F., Iunevich, D. P., and Ignat'eva, V. M. DEEP DRAINAGE OF SWAMPS IN DEPRESSIONS. (Rus) Gidrotekh. i Melior. 1960(5): 24-36, map. Ref. May 1960. 290.8 G362

4829. Aver'yanov, S. F., Yunevich, D. P., and Ignat'eva, V. M. THE DEEP DRAINAGE OF LOWLAND SWAMPS. Gidrotekhnika i Melioratsiya (Moskva) 10: 24-36. 1960 (Translated from Russian) Off. Tech. Serv. Washington, D. C. OTS 61-31071, 17 pp. 1962.

The deep drainage of peat bogs was considered essential for lowland swamp drainage as it ensures peat bog amelioration to a great depth and creates conditions favorable for increased crop yields.

4830. Baden, W., and Segeberg, H. DRAINAGE NEED OF MARSHES AND INFLUENCING THEIR WATER AND AIR MANAGEMENT BY DRAINAGE. (Ge) Wasser u. Boden 12(9): 326-332. Sept. 1960. 56.8 W28

4831. Bakhulin, M. D. AGRICULTURAL EVALUATION OF MARSHES BASED ON THE EXAMPLE OF KULIKOVO MARSH LAND, LAKHROMA VALLEY. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, Minsk. pp. 450-456. 1956 54.9 K83

4832. Barashev, V. F. RECLAMATION OF PEAT BOGS FOR VEGETABLE CROPS (FROM THE EXPERIENCE OF COLLECTIVE FARMS IN SOLOTCHINSK DISTRICT, RIAZAN REGION). (Rus) In OVOSHCHEVODSTVO OTKRYTOGO GRUNTA (SBORNIK STATEI). Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziastvennoi Literatury, pp. 307-315. 1957. (Peredovoi Opyt v Sel'skom Khoziaistve) 91 Ov65

4833. Booy, A. H. THE HIGH MOOR PEAT OF DRENTE, RECLAIMED PEAT MOORS AND THEIR FUTURE. (Du) Boor en Spade 8: 56-73. Ref. 1957. 56.9 B64
English summary.

A report was given on the early use and misuse of high moor peat in Drente, Netherlands. The future of the area was discussed. Areas where the peat has been removed have been very hard to reclaim.

4834. British Columbia Dept. of Agriculture, Field Crops Branch. PEAT AND MUCK SOILS. Brit. Columbia Dept. Agr. Field Crops Br. Soils Ser. 5, 4 pp. 1961. 56.9 B772

A publication was given on the reclamation by drainage and the management of peat and muck soils in England.

4835. Bronnikova, L. V. SOME PROBLEMS OF RECLAMATION OF DRAINED MARSHES OF THE VOLYN AREA. (Uk) Lutsk. Volyns'ka Derzhavna Sil's'kohospodar. Doslid. Sta. Nauk. Pratsi 1: 97-105. 1961. 106 L972

4836. Budyka, S. K. DRAINAGE AND UTILIZATION OF FOREST SWAMPS AND SWAMPY LANDS OF POLESYE LOWLAND. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 31: 81-88. 1955. 99.9 Ak1

4837. Commonwealth Bureau of Soils. BIBLIOGRAPHY ON RECLAMATION OF SWAMPS (1960-1940). Commonwealth Bur. Soil Sci. (Annot. Bibliog.), 5 pp. Jan. 1961. 241 C734A

An annotated bibliography was given of articles published during 1940-60 on the reclamation of swamps.

4838. Cramer, R. E. AGRICULTURAL DEVELOPMENTS ON THE PAMLICO PENINSULA, EASTERN NORTH CAROLINA--A STUDY IN DRAINAGE RECLAMATION. (Abs.) Assoc. Amer. Geog. Annu. 49(2): 176. June 1959. 500 As73

An abstract was given of an article on the development of the Pamlico Peninsula, N. C., by drainage of the swamplands and their use for cropland.

4839. Cross, P. E. THE FENS--PAST, PRESENT AND FUTURE. Agr. Prog. 38: 25-33. 1963. 10 Ag86

A report was given on the past, present, and future of the fens in England.

4840. Cuthbertson, J. A. ASPECTS OF DITCHING AND DRAINAGE TECHNIQUES IN MUSKEG AREAS. Natl. Res. Council, Canada. Assoc. Comt. Soil & Snow Mech. Tech. Memo. 61: 62-74. June 1959. 290.9 N216

A report was given on ditching and drainage techniques in muskeg areas of Canada.

4841. Dalby, R. PROBLEMS OF LAND RECLAMATION. V. Salt Marsh in the Wash. Agr. Rev. 2(11): 31-37. Apr. 1957. 30.08 Ag8

A report was given on the reclamation of a salt marsh in an area called the Wash in England by open ditch linings.

4842. Davis, J. F. FARMING ON PEAT & MUCK SOILS IN MICHIGAN. Mkt. Growers J. 85(1): 16-17, 19. Jan. 1956. 6 M34

This discussion of the farming of peat and muck soils includes a report on the drainage requirements of these areas. Recommendations for both open ditches and tile drains were given.

4843. Einarsson, E. H. RECLAMATION OF MARSHES. (Ic) Freyr 59(19): 355-357. Oct. 1963. 11 F89

4844. Elliott, I. L. THE DEVELOPMENT OF PEAT AREAS IN THE WAIKATO. New Zeal. Soc. Soil Sci. Proc. 3: 33-37. 1958. 56.09 N48

A report was given of the methods used to develop peat areas in New Zealand for pasture land. The use of open drains and mole drains were discussed.

4845. Eylands, A. G. MARSHES AND MARSH CULTURE ON ICELAND. (No) Norske Myrselsk. Meddel. 62 (3): 69-89. June 1964. 11 N813

4846. Eyre, J. D. JAPANESE LAND DEVELOPMENT IN KOJIMA BAY. Econ. Geog. 32: 58-74. Jan. 1956. 278.8 Ec7

A report was given on past and present reclamation of coastal swamps and shallow water in the Kojima Bay area of Japan.

4847. Fabianowicz, M., and Okruszko, H. POLISH BIBLIOGRAPHY ON PEAT FOR THE PERIOD 1918-1957. (Po) Rocz Nauk Roln. 74(1): 147-210. 1960. 20.5 R59
English summary, pp. 151-153.

A bibliography of peat was given for the period 1918-1957 by Polish authors and articles translated into Polish. Articles on drainage of peat lands were included.

4848. Fialkovsky, P. G., and Khrustalev, V. M. RECLAMATION OF SWAMPS AND WATER LOGGED LANDS IN THE R. S. F. S. R. Internatl. Commn. Irrig. & Drain. Annu. B. 1957: 44-48. 1957. 55.9 In8A

The reclamation of swamps and waterlogged lands in the Soviet Union stretching from the Baltic Sea to the Sea of Okhotsk was reported. The following reclamation methods have proved the most successful: (1) Covered tile drainage combined with mole drainage or with special methods of soil cultivation; (2) a narrow but deep open drain network designed for stable ground water lowering and creating an accumulating layer absorbing the surplus rainfall; and (3) an open ditch network combined with mole drainage or with temporary agromelioration measures to increase moisture holding capacity and accelerate the surface water runoff from the reclaimed areas.

4849. Filipowicz, J. INVESTIGATIONS OF PEATLANDS AND GOALS RESULTING FROM NEED OF PEAT MANAGEMENT. (Po) Zeszyty Prob. Postepow Nauk Roln. 34: 5-12. 1962. 20.5 Z5
English summary.

A report was given on investigations of soil management and land use of peatlands in Poland.

4850. Fujimori, N., Konno, I., and Miyazaki, N. INVESTIGATIONS ON THE FLOATING OF RICE PLANT CAUSED BY SWELLING OF PEAT ON THE HIGH PEAT PADDY FIELD. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 79-85. Feb. 1956. 107.6 H68
English summary.

A report was given on the value of mineral soil on peat paddy fields in Japan to stop the floating of rice plants caused by the swelling of the peat.

4851. Fujimori, N., and Miyazaki, N. RELATION BETWEEN THE METHODS OF RIDGE CONSTRUCTION AND AMOUNT OF EXFILTRATION WATER ON HIGH PEAT PADDY FIELD. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 75-78. Feb. 1956. 107.6 H68
English summary.

A report was given on the value of a ridge of mineral soil for rice production on a high peat paddy field in Japan to reduce the exfiltration of water.

4852. Fujimori, N., Miyazaki, N., Matsumi, S., Sawada, T., and Nakane, M. THE IMPROVEMENT OF HIGH MOOR PEAT WITHOUT SOIL DRESSING. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 23-58. Ref. Feb. 1956. 107.
English summary.

A comparison was given on the improvement in Japan of peat soil with and without the addition of mineral soil by the use of fertilizers, corrected acidity, and/or trace elements.

4853. Getov, L. V. THE CHANGES IN THE WATER PERMEABILITY OF PEAT-BOG SOILS RESULTING FROM DRAINAGE. 13 pp. (OTS 63-11020) Transl. 13513
Translation from Beiorusskii Nauchno-Issiedovatel'skii Institut Melioratsii i Vodnogo Khozyaistva. Trudy 8: 313-327. 1958.

A report was given on the changes of water permeability of peat bogs in the U.S.S.R. due to drainage.

4854. Gondaira, S., Yamamoto, S., and Umeda, Y. ON SWELLING AND DEFORMATION IN DIGGING OPEN CHANNELS AT PEAT-BOGS, TOYOHORO DISTRICT. II. (Ja) Hokkaido U. Fac. Agr. Mem. 3(2): 300-309, map. 1959. 107.6 H682
English summary.

Observations were reported of the swelling and deformation found when open channels were dug through peat bogs in this area of Japan.

4855. Gorbachev, I. P. PRACTICES IN RECLAMATION OF PEAT BOG SOILS. (Rus) Zemledelie 4(9): 107-109. Sept. 1956. 20 Z44

4856. Gorinskii, V. N. DRAINAGE OF MARSHES AND RECLAMATION OF NEW LANDS IN FINLAND. (Rus) Zemledelie 5: 77-79. May 1963. 20 Z44

4857. Green, V. E., Jr. THE CULTURE OF RICE ON ORGANIC SOILS--A WORLD SURVEY. Agron. J. 49: 468-471. 1957. 4 Am 34P

Organic soils are being used more widely to grow rice. Unusual problems have arisen and much progress is being made toward their solution. The advantages and disadvantages of organic soil as a medium for rice were given. The effects of rice culture on the peat were presented. A world survey was given on rice culture on organic soils.

4858. Haabeth, M. DRAINAGE OF MARSHES AND WATERLOGGED FORESTS. (No) Norsk Landbr. 18: 406, 413. Aug. 29, 1958. 11 N8122

4859. Hagerup, H. RESULTS OF DRAINAGE EXPERIMENTS ON MARSH LAND IN NORWAY. (No) Nord. Jordbrforsk. 36: 541-546. 1954. 11 N752

4860. Hatch, W. R. IRISH RECLAIM BOG FOR FARMS, FORESTRY. Foreign Agr. 25(12): 14-15. Dec. 1, 1961. 1.9 Ec7For

A report was given on the drainage and reclamation of peat bogs for farms and forestry in Ireland. The research activities include peat bogs where part of the peat has been removed by harvesting.

4861. Heikurainen, L. THOUGHTS ON THE WATER ECONOMY OF PEAT LANDS. (Fi) Suo 15(2): 37-43. Ref. Aug. 20, 1964. 54.8 Su7
English summary.

A report was given on the need of additional research on the water economy of peat lands for forest crops in Finland.

4862. Heikurainen, L., Paivanen, J., and Sarasto, J. GROUND WATER TABLE AND WATER CONTENT IN PEAT SOIL. Acta Forest. Fenn. 77(1), 18 pp. Ref. 1964. 99.9 F492

A report was given on the effect of the ground water table by drainage on the water content of peat soil in Finland. There was a close rectilinear correlation between the ground water table and the water content of surface peat. With the peat tested, a change of 10 cm. in the level of the ground water in the surface layer (0-20 cm.) corresponded to a change of about 5 volume percent.

4863. Hollander, R. D'. THE POITEVIN MARSH. (Fr) Paris. Ecole Prat. des Hautes Etudes. Sixieme Sect. Sci. Econ. et Soc. Etudes Rur. 3: 81-90, maps. Oct./Dec. 1961. 281.9 P21

4864. Horiguchi, H. A BIBLIOGRAPHY OF THE PEAT LAND AGRICULTURE IN HOKKAIDO, WITH SPECIAL REFERENCE TO THE RESEARCH PROGRESS. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 152-165. Feb. 1956. 107.6 H68
English summary.

A bibliography was given on research progress on peat land agriculture in Hokkaido, Japan.

4865. Hovd, A. EXPERIMENTS ON MARSHES IN NAMDAL. (No) Norske Myrselsk. Meddel. 53: 96-98. June 1955. 11 N813

4866. Hovd, A. CULTIVATION OF PEAT BOGS. (No) Norske Myrselsk. Meddel. 54: 1-11. (Cont.) Feb. 1956. 11 N813

4867. Hovd, A. CULTIVATION OF PEAT BOGS. (No) Norske Myrselsk. Meddel. 54: 65-72. (Cont.) Ref. Apr. 1956. 11 N813

4868. Hovde, O. THE MARSHES IN FILLAN PARISH SOUTH TRONDELAG PROVINCE. (No) Norske Myrselsk. Meddel. 53: 85-92. June 1955. 11 N813

4869. Hovde, O. MARSHES ON FROYA. (No) Norske Myrselsk. Meddel. 61(3): 57-72, map. Ref. June 1963. 11 N813

4870. Hsia-Tien, H. FROM MARSH TO STATE FARM. China Reconstructs 11 (10): 34-37. Oct. 1962. 280.8 C447

A report was given on the development of a marsh area in China.

4871. Huikari, O. IMPROVING SOIL FERTILITY ON DRAINED PEAT SOIL. (Sw) Vaxt-Narings-Nytt 18(2): 16-22. 1962. 57.8 V47
English summary, p. 3-4 of supplement.

A report was given on improving soil fertility on drained peat forest soils in Finland. Results of experiments on the use of clay, sand, ash, or fertilizer were given.

4872. Ishizuka, Y. and Tanaka, A. NUTRIOPHYSIOLOGICAL AND EDAPHOLOGICAL STUDIES ON RICE CULTURE IN PEAT SOIL, ESPECIALLY ON THE SIGNIFICANCE OF MINERAL SOIL DRESSING ON THE PEAT SOIL. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 86-102. Feb. 1956. 107.6 H68
English summary.

A report was given on the advantages of adding a topdressing of mineral soil on peat paddy soils in Japan.

4873. Iunevich, D. P. THE METHOD OF BOTTOM DRAINAGE OF MARSHES. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, pp. 110-114. Minsk, 1956. 54.9 K83

4874. Jarrett, G. MOORLAND RECLAMATION IN NORTH SOMERSET. Gt. Brit. Min. Agr. Fisheries & Food. Agriculture 65(4): 191-194. July 1958. 10 G79J

A report on the reclamation of moorland in Great Britain was given along with some difficulties of drainage and cultivation of the area.

4875. Jasmin, J. J., and Heeney, H. B. RECLAIMING ACID DOME PEAT BOGS FOR AGRICULTURAL USE. Canada. Dept. Agr. P. 1089, 15 pp. Oct. 1960. 7 C16Pu

A report was given on the drainage and fertility needs to reclaim acid dome peat bogs in Canada.

4876. Jensen, S. T. THE NORTH SEA MARSHES AND THEIR UTILIZATION FOR FARMING. (Da) Tidsskr. f. Planteavl 59: 291-327. Ref. 1955. 11 T439

4877. Jonsson, A. L. SOME WORDS ON MARSH DRAINAGE. (Ic) Freyr 59(8): 157-161. Apr. 1963. 11 F89

4878. Kachuko, I., and Guleichik, K. ECONOMIC EFFICIENCY OF CAPITAL INVESTMENTS INTO LAND-IMPROVEMENT. (Rus) Ekon. Sel'sk. Khoz. 30(7): 35-39. Oct./Nov. 1959. 281.8 So73

4879. Kachuro, I. M., and Guleichik, N. A. ECONOMIC EFFECTIVENESS OF DRAINAGE AND OF RECLAMATION OF PEAT-BOGGY LANDS IN BELORUSSIA. (Rus) In Akademiya Sel'skokhozyaistvennykh Nauk Imeni V. I. Lenina. Otdelenie Ekonomiki i Organizatsii Sel'skokhozyaistvennogo Proizvodstva. EKONOMICHESKAYA EFFEKTIVNOST' KAPITAL'NYKH VLOZHENII V SEL'SKOE KHOZYAISTVO, pp. 232-237. 1962. 284 Ak12

4880. Kanno, I., Honjo, Y., Arimura, S., Tokudome, S., and Kuwano, Y. PADDY SOILS IN THE TSUKUSHI PLAIN, NORTHERN KYUSHU. (Ja) Kyushu Agr. Expt. Sta. B. 5(4): 311-348, map. Ref. Nov. 1959. 107.6 K996B
English summary.

A study was reported of some paddy soils in Japan where the rice plants suffer "Akiochi phenomenon (late degradation of growth)." Dressings to the soil of muddy marine sediments which had montmorillonite minerals and bases were the most effective of the methods used to correct the phenomenon.

4881. Karmon, Y. THE DRAINAGE OF THE HULEH SWAMPS. Geog. Rev. 50(2): 169-193, maps. Apr. 1960. 500 Am35G

A report was given on the drainage of the Huleh swamps in Israel.

4882. Keltikangas, V. ON THE SUITABILITY OF BOGS FOR AFFORESTATION DRAINING. (Fi) Suo 9(6): 85-88. Ref. Dec. 30, 1958. 54.8 Su7
English summary.

A report was given on the drainage of bogs for the development of forests (including costs) was given for Finland. Draining was recommended on the following areas: (1) Bog types of high quality; (2) bogs growing forests originally; and (3) bogs of high quality now in forests.

4883. Khrenova, E. G. IN REGARD TO REGULATING THE WATER REGIME OF OLD PEAT-BOG SOIL OF IAKROMA BASIN. (Rus) Mosdov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiriazeva. Dok. TSKHA 26: 96-101. 1956. 20 M857

4884. Klimov, I. V. DRAINAGE AND UTILIZATION OF SWAMPS IN THE NORTH. (Rus) Gidrotekh. i Melior. 4: 56-59. Apr. 1964. 290.8 G362

4885. Konferentsiia po Melioratsii i Osvoeniiu Bolotnykh i Zabolochennykh Pochv, 1955. PROCEEDINGS OF THE CONFERENCE ON THE RECLAMATION AND UTILIZATION OF MARSHES AND SWAMPY SOILS, APRIL 15-19, 1955. Minsk, 471 pp. 1956. 54.9 K83

4886. Kozhanov, K. I. METHOD OF STUDYING THE PRESENT-DAY SYSTEMS OF HYDROTECHNICAL RECLAMATION OF MARSHES. (Rus) In KONFERENTSIIA PO MELIORAFSII I OSVOENIIU BOLOTNYKH I ZABOLOCHEMYKH POCHV, 1955. Trudy, p. 121-126. Minsk, 1956. 54.9 K83

4887. Krupnova, G. F. DRAINAGE AND RECLAMATION OF MARSHY LAND; A RECOMMENDED BIBLIOGRAPHY. (Rus) Leningrad, 31 pp. 1957. 241 K94

4888. Kuntze. MELIORATION CAPACITY OF MARSH SOILS FROM SOIL SCIENCE ASPECT. (Ge) Wasser u. Boden 10(11): 354-356. Nov. 1958. 56.8 W28

4889. Laverton, S. THE DRAINAGE OF SWAMPY GROUND. (Fr) Rev. Vinic. y de Agr. 1889: 26. Aug. 1959. 390.8 R322

4890. Lavrov, A. V. FROM THE EXPERIENCES OF DRAINING SWAMPS AND STAGNANT LANDS IN THE GERMAN DEMOCRATIC REPUBLIC. (Rus) Gidrotekh. i Melior. 8(2): 51-60. Feb. 1956. 290.8 G362

4891. Lie, O. RECLAMATION OF MARSHES. (No) Norsk Landbr. 21: 498-502. Oct. 28, 1955. 11 N8122

4892. Lie, O. DRAINAGE OF MARSHES. (No) Norske Myrselsk. Meddel. 53: 172-185. Ref. Dec. 1955. 11 N813

4893. Loddesol, A. INTERNATIONAL PEAT SYMPOSIUM IN DUBLIN 1954. (No) Norske Myrselsk. Meddel. 53: 120-132. Aug. 1955. 11 N813

4894. Lustig, H. EXTENSIVE RECLAMATION OF MARSHES IN NORTH WESTERN GERMANY. (Sw) Svensk Valltidskr. 2(2): 55-58. 1963. 60.8 Sv22

4895. Malmstrom, C. POSSIBILITIES FOR CHANGING MARSHLAND INTO PRODUCTIVE FOREST LAND. (Sw) Beten-Vallar-Mossar 8: 125-130. Oct. 1956. 11 B46

4896. Matsumi, S. STUDIES ON THE MATURING PROCESS OF PEAT SOILS. I. THE CHANGE OF PHYSICAL AND CHEMICAL PROPERTIES AFTER RECLAMATION. (Ja) Hokkaido Natl. Agr. Expt. Sta. Res. B. 69: 1-7. Feb. 1956. 107.6 H68
English summary.

A report was given on the physical and changes of peat soil after reclamation by the addition of mineral soils in Japan.

4897. Mikhkiev, A. I., and Koivunen, T. M. RECLAMATION OF BOGGY LANDS IN FINLAND. (Rus) Gidrotekh. i Melior. 1: 62-64. Jan. 1963. 290.8 G362

4898. Mikola, I. OBSTACLES TO DRAINAGE IN SWAMPS WITH DEEP PEAT. (Fi) Suo 14(1): 2-5. May 6, 1963. 54.8 Su7
English summary

A report was given on obstacles in Sweden to the drainage of deep peat areas in swamps.

4899. Mirkin, S. L., and Skrynnikova, I. N. SCIENTIFIC CONFERENCE ON PROBLEMS OF RECLAMATION AND UTILIZATION OF BOGS AND SWAMPY LANDS OF THE NON-CHERNOZEM AREA FOR AGRICULTURE. (Rus) Pochvovedenie 9: 67-69. Sept. 1955. 57.8 P34

4900. Muller, W., and Hall, G. DRAINAGE OF MARSH PROPERTIES IN KEHDINGEN. (Ge) Wasser u. Boden 13(9): 329. Sept. 1961. 56.8 W28

4901. Nickels, N. RECLAMATION ON COLD CREEK. Timber Canada 24(10): 26-27. Oct. 1963. 99.81 T487

A report was given on the improvement of swampland in Canada by draining and then planting spruce and pine seedlings.

4902. Noest, J. THE BRABANT BIESBOSCH. (Du) Nederland. Heidemaatsch. Tijdschr. 74(1): 5-16, map. Jan. 1963. 12 N282

4903. Novikov, M. I. ON THE CONSTRUCTION OF ROADS ON MARSHES WHICH ARE BEING DRAINED. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCHV, 1955. Trudy, Minsk, pp. 186-194. 1956. 54.9 K83

4904. Odegaard, M. L. RECLAMATION OF MARSHLAND IN NORTH-NORWAY. (No) Ny Jord 45(2): 36-45. 1958. 282.28 N98

4905. Odegaard, M. L. THE VESTERAL MARSHES--PAST, PRESENT AND FUTURE. (No) Ny Jord 50(5): 181-187. Oct. 1963. 282.28 N98

4906. Okruszko, H. STATE AND RESULTS OF IMPROVEMENT AND MANAGEMENT OF KUWASY PEAT BOGS. (Pol) Warsaw. Inst. Melior. i Uzytkow Zielonych. Wiad. 3(3): 145-159. 1963. 54.9 W262W

4907. Olofsson, S. DRAINAGE OF PEAT SOILS. (Sw) Beten-Vallar-Mossar 8(10): 149-150. Nov./ Dec. 1956. 11 B46

4908. Parys, A. Van. DRAINED MARSH CULTURES IN ITURI. (Fr) Inst. Natl. pour l'Etude Agron. du Congo Belge. B. d'Inform. 8(6): 375-390. 1959. In B. Agr. du Congo Belge et du Ruanda-Urundi 50(6). Dec. 1959. 24 K83.

4909. Pessi, Y. THE EFFECT OF CLAYING UPON THE SETTLING OF THE SOIL SURFACE ON CULTIVATED SPHAGNUM BOGS. Suomen Maataloustiet. Seura. Maataloustiet. Aikakausk. 32(1): 5-7. 1960. 20 Su7M

Where clay had been added to a sphagnum bog area 35 years previously, the surface area had settled 12.5 cm. more than the unclayed bog in Finland.

4910. P'iavchenko, N. I. RECLAMATION OF DRAINED MARSHES. (Rus) Priroda 44(8): 98-101. Aug. 1955. 410 P933

4911. P'iavchenko, N. I. RECLAMATION OF MARSHY AREAS--ONE OF THE MOST IMPORTANT WAYS OF DEVELOPING AGRICULTURE IN THE FOREST AREA. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 26: 5-16. Ref. 1955. 99.9 Ak1

4912. Pressi, Y. THE EFFECT OF CLAYING CARRIED OUT IN 1923 UPON THE THERMAL CONDITIONS IN CULTIVATED SPHAGNUM PEAT SOIL IN THE SUMMER OF 1959. Suomen Maataloustiet. Seura. Maataloustiet. Aikakausk. 32(1): 1-4. Ref. 1960. 20 Su7M

A report was given on the effect of adding clay to sphagnum peat moss soil in Finland. The area with the clay averaged 1° C. higher soil temperature after 36 years.

4913. P'yavchenko, N. PROSPECTS OF DRAINAGE OF SIBERIAN BOGS. (Rus) Sel'sk. Khoz. Sibiri 1961 (11): 59-61. Nov. 1961. 20 Se492

4914. Riga. Latviiskii Nauchno--Issledovatelskii Institut Gidrotekhniki i Melioratsii. PROBLEMS IN UTILIZING THE DRAINED PEAT-BOG SOILS OF LATVIAN SSR. (Rus) Riga, Akademiia Nauk Latviiskol SSR, 1957. 142 pp. 56.26 R44

4915. Riga. Latviiskii Nauchno--Isledovatel'skii Institut Gidrotekhniki i Melioratsii. PROBLEMS OF DRAINAGE AND UTILIZATION OF DRAINED LANDS. (Rus) V. 1, Riga, Ministersto sel'skogo khoziaistva Latviiskoi SSR. 267 pp. 1958. 54.9 R44

4916. Risku, A. PEAT LAND DRAINING PROJECTS IN THE REGION OF THE AGRICULTURAL ENGINEERING DISTRICT OF LAPLAND. (Fi) Suo 11(2): 34-38. June 20, 1960. 54.8 Su7
English summary.

A report was given on the progress of peat land drainage projects in Lapland.

4917. Robertson, R. A. PEAT RECLAMATION. Roy. Highland & Agr. Soc. Scot. Trans. (ser. 6)2: 38-54. 1958. 10 H536

4918. Ronchi, V. AGRICULTURAL RECLAMATION AND DRAINAGE OF UNPRODUCTIVE OR SCARCELY PRODUCTIVE LAGOONS OR SWAMPS. (It) Agr. delle Venezie 9: 505-511. Oct. 1955. 16 Ag826

4919. Scharff, E. CULTIVATION OF THE "GREAT SWAMPS" IN THE HELMSTEDT AND WOLFENBUTTEL DISTRICTS. (Ge) Wasser u. Boden 10(4): 86-88. Apr. 1958. 56.8 W28

4920. Schmeidl, H. COMPARATIVE OBSERVATIONS ON WATER BALANCE AND CLIMATE ON UNCULTIVATED AND CULTIVATED HIGH PEAT BOGS IN SOUTHERN BAVARIA. III. RESULTS OF COMPARATIVE OBSERVATIONS OF CLIMATE ON UNDISTURBED AND CULTIVATED HIGH PEAT BOG EXPANSES IN THE SOUTHERN CHIEMSEE BOGS AND ON THE BOG EDGES. (Ge) Mitt. f. Landkult. Moor-u. Torfwirt. 8(2/3): 108-127, map. June/Sept. 1960. 60.1 M69

4921. Scholz, A. DAMMING OF WATER ON SAND-BASED FLAT LOW MOOR AND PART-MOOR SOILS. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 4(3): 118-119. Mar. 1963. 18 W763

4922. Shchitnikov, P. I. EXPERIENCE IN DRAINING AND UTILIZING BOGGED-UP SOILS IN THE "POLESYE." (Rus) Gidrotekh. i Melior. 1961(3): 48-55, maps. Mar. 1961. 290.8 G362

4923. Shuravilin, A. V. DRAINAGE OF SWAMPS IN FLOOD-PLAINS OF NORTHERN DVINA RIVER. (Rus) Gidrotekh. i Melior. 5: 28-36. May 1964. 290.8 G362

4924. Skodshoj, H. IRISH BOGS. (Da) Hedeselsk. Tidsskr. 80(3): 35-45. Mar. 10, 1959. 11 H35

4925. Skoropanov, S. G. INTENSIVE UTILIZATION OF DRAINED LANDS. (Rus) Gidrotekh. i Melior. 6: 3-8. June 1963. 290.8 G362

4926. Skrynnikova, I. N. SCIENTIFIC AND RESEARCH WORK IN THE DOMAIN OF RECLAMATION OF BOG SOILS IN THE GERMAN DEMOCRATIC REPUBLIC. (Rus) Pochvovedenie 1957(6): 114-115. June 1957. 57.8 P34

4927. Smirnov, T. E. THIS WAS ONCE A SWAMP AREA. Moskva, Izd-vo selkhoz lit-ry, zhurnalov i plakatov. 102 pp. 1963. 54 Sm42

4928. Smith, R. F. FRODSHAM MARSHES RECLAIMED. Gt. Brit. Min. Agr. Fisheries & Food. Agriculture 64(7): 323-326. Oct. 1957. 10 G79J

Special problems (roads, drainage, water supply, and variable soil conditions) of estate management of reclaimed land from the Frodsham Marshes in Cheshire were given. Methods used to solve the problems were outlined.

4929. Staff Writer. CATTLE WALKWAYS IN MARSH RANGE. Land and Water Contract. 3(7): 9-11. 1961. 56.8 L222

Coastal Louisiana stockmen are using this conservation practice to open vast new acreage to winter forage at relatively low cost. The practice is dragline-built cattle walkways, man-made high ground to provide livestock with access routes into the marsh. By building a mile of walkway, usually at a cost of less than $2,000, a stockman can open up a whole half section of virgin marsh rangeland. Often he can connect existing high ground with roadlike earth fill structures and open up a vast new range at little cost.

The cattle walkways open up new areas to grazing, and by proper spacing and the use of gates, fences, and other controls on the walkways themselves, grazing can be distributed uniformly over a large range.

Walkways serve as bed grounds, calving areas, and feeding sites. They offer livestock some relief from mosquitoes.

4930. Stankevich, V. S., and Rubin, P. R. DRAINAGE AND RECLAMATION OF PEAT BOGS AND MARSHY LANDS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury. 77 pp. 1956. 54 St2

4931. Stephens, J. C. DRAINAGE OF PEAT AND MUCK LANDS. U. S. Dept. Agr., Agr. Ybk. 1955: 539-557. 1955. 1 Ag84Y

The principles and practices of drainage of peat and muck lands were given. The use of open ditches, tile, and mole drainage for drainage were discussed.

4932. Svirin, V. I. HOW WE ARE RECLAIMING THE SWAMP. (Rus) Sad i Ogorod 4: 17-18. Apr. 1956. 80 Sa13

4933. Talureau, R. IMPROVEMENT OF THE TERRAIN IN THE SWAMP REGIONS OF THE WEST. (Fr) France. Min. de l'Agr. Rev. Etudes & Monog. 1957(127): 53-62. Mar. 1957. 281.8 F84

4934. Thompson, K. ORIGIN AND USE OF THE ENGLISH PEAT FENS. Sci. Mon. 85(2): 68-76. Ref. Aug. 1957. 470 Sci23

A report was given on the origin and use of English peat fens. The areas are drained by both open ditches and closed drains. Excess water in some drains have to be removed by pumping as it is several feet below sea level. Peat formation under the former marsh conditions has been replaced by peat destruction under reclamation. Peat conservation was discussed by: Drainage modification; claying; extension of grassland; and wind erosion preventives.

4935. Tyulenev, N. A., and Shelestov, Y. V. RECLAMATION OF BOGS OF THE FOREST-STEPPE ZONE IN UKRAINE. (Rus) Sakh. Svekla 1962(5): 14-15. May, 1962. 66.8 Su393

4936. Uhden, O. THE BIG MARSH AT OSTENHOLZ. (Ge) Schrreihe. des Kuratoriums f. Kultbauw. 9, 159 pp., maps. Ref. 1960. 18 Sch73
English summary.

A study was reported of the subsidence of a drainage peat bog in Germany.

4937. Valk, U. FORESTRY AND AGRICULTURAL PROBLEMS OF UTILIZING UNFORESTED HIGH BOGS IN ESTONIA. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 106-115. Ref. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the problems of utilizing unforested high bogs in Estonia for forest crops. Some areas are drained and farmed for several years before being planted to trees. Abandoned cropland areas needed extensive fertilization and cultural practices plus drainage before a successful forest could be established.

4938. Veelen, W. I. C. Van. DRAINAGE AND OPENING OF THE FEN COLONIES. (Du) (sum.) Landbk. Tijdschr. 70(2): 100. Feb. 1958. 105.2 Or3

4939. Verkoren, J. LAND IMPROVEMENT POSSIBILITIES IN THE FEN COLONIES. (Du) Landbk. Tijdschr. 70(2): 102-114. Feb. 1958. 105.2 Or3

4940. Verner, A. RECLAMATION OF MARSHES FOR AGRICULTURE IN WESTERN SIBERIA. (Rus) Sel'sk. Khoz. Sibiri 1958(1): 23-27. Jan. 20, 1958. Se492

4941. Verner, A. R. RECLAMATION OF PEAT BOGS OF THE BARABA PLAIN. (Rus) *In* VOZDELYVANIE SEL'SKOKHOZIAISTVENNYKH KUL'TUR V SIBIRI. Moskva, Gosudarstvennoe Izdatel'stvo Sel' skokhoziaistvennoi Literatury. pp 19-29. 1956. 33.31 V94

4942. Vuento, P. ON THE PRACTICE OF BASAL DRAINING OF PEAT LANDS. (Fi) Suo 11(2): 26-28. June 20, 1960. 54.8 Su7
English summary.

Observations and investigations were reported on the performance of basal draining of peat lands in Lapland. Suggestions were given on the improvement of drainage in the Area.

4943. Walsh, T., O'Hare, P. J., and Quinn, E. THE USE OF PEATLAND IN IRISH AGRICULTURE. Advn. Sci. 14(57): 405-416. June 1958. 501 B77A

A report was given on the use of peatland for agriculture in Ireland.

4944. Wiebing, R., and Wind, G. P. IMPROVEMENT OF FEN COLONY GROUND. (Du) Wageningen. Inst. Cultuurtech. Waterhuishouding. Verspreide Overdrukken 10. 11 pp. 1963. 282.9 W12V

4945. Williams, R. E. THE AMAZING MARSHLANDS. Soil & Water Mag. 5(12): 24-26. Dec. 1956. 54.8 So3

A report was given on the use of the Gulf Coast Marshes in South Louisiana and Southeast Texas by cattle, wildlife, gardens, and small fields. Level open ditches for drainage was stressed.

4946. Wold, E. GLIMPSES FROM MARSH RECLAMATION IN NORTH-GERMANY AND DENMARK. (No) Norske Myrselsk. Meddel. 57(4): 142-148. Aug. 1959. 11 N813

4947. Zubets, V. M. PROBLEM OF POLESYE WILL BE SOLVED. (Rus) Vest. Sel'skokhoz. Nauki 1961(3): 132-137. Mar., 1961. 20 V633.

SEE ALSO--14, 86, 184, 378, 419, 421, 425, 426, 433, 465, 486, 490, 494, 496, 518, 520, 541, 542, 551, 558, 577, 578, 612, 613, 621, 634, 646, 647, 649, 651, 670, 688, 694, 702, 710, 735, 736, 744, 754, 756, 766, 767, 770, 780, 782, 783, 798, 813, 818, 843, 844, 853-855, 863, 872, 880, 889, 891, 894, 911, 928, 929, 931, 950, 955, 957, 959, 962, 977, 993-995, 999, 1012, 1036, 1037, 1038, 1042-1044, 1074, 1076, 1085, 1106, 1107, 1110, 1121, 1126, 1128, 1137, 1185, 1201, 1206, 1249b, 1258, 1331, 1363, 1409, 1450, 1502, 1526, 1528, 1619, 1620, 1630, 1661, 1696, 1700, 1722, 1742, 1745, 1768, 1777, 1810, 1835, 1836, 1920, 1928, 1930, 1932, 1952, 1979, 1995-1998, 2002, 2034, 2067, 2104, 2115, 2136, 2137, 2181, 2211, 2251, 2252, 2259, 2265, 2267, 2312, 2321, 2326, 2365, 2367, 2388, 2404, 2405, 2424-2426, 2431, 2432, 2439, 2440, 2443-2455, 2488, 2497, 2512, 2530, 2534, 2546, 2547, 2552, 2553, 2558, 2572, 2579, 2580, 2581, 2601, 2602, 2604, 2610, 2616-2618, 2621, 2634, 2636-2640, 2650-2652, 2658, 2659, 2671-2673, 2682, 2683, 2692, 2701, 2705, 2709, 2720, 2735, 2743, 2747, 2749, 2750, 2756, 2757, 2762, 2774, 2776, 2781, 2783, 2786, 2787, 2796-2798, 2807, 2810, 2826, 2829, 2831, 2833, 2834, 2836, 2838-2840, 2848, 2866-2868, 2870, 2877, 2880, 2882, 2883, 2886, 2888, 2889, 2891, 2892, 2898, 2899-2903, 2909, 2913, 2914, 2921, 2925-2927, 2936, 2941-2944, 2946, 2949-2952, 2960, 2972, 2980, 2982, 2987, 2991-2993, 3216, 3249, 3330, 3334, 3389, 3399, 3401, 3408, 3432, 3437, 3440, 3441, 3443, 3446, 3487, 3492, 3497-3499, 3532, 3535, 3574, 3580, 3629, 3633, 3671, 3706, 3718, 3749, 3760, 3828, 3829, 3841, 3857, 3890, 3908, 3914, 3920, 3928, 3934, 4003, 4011, 4033, 4071, 4098, 4106, 4133, 4139, 4140, 4189, 4250, 4267, 4269, 4284, 4287, 4290, 4297, 4299, 4308, 4330, 4331, 4367, 4397, 4400, 4420, 4430, 4431, 4435, 4442, 4516, 4566, 4567, 4579, 4600, 4759, 4948, 4952, 4957, 4963, 4967, 4969, 4970, 4973, 4984, 4985, 4990-4992, 5000, 5002, 5003, 5005, 5009, 5011, 5016, 5017, 5020, 5022, 5025, 5039, 5042a, 5051, 5053, 5073, 5081, 5083, 5086.

Forest Drainage

4948. Alho, P. IMPROVEMENT OF THE CONDITION OF THE FORESTS IN NORTHERN FINLAND. (Fi) Teho 9: 433-435. 1961. 20 T98
English summary, p. 462.

A report was given of the improvement of forests in Northern Finland by drainage of the marsh areas and improved methods of silviculture.

4949. Babinski, S. DISCUSSION UPON WATER DRAINAGE IN FORESTRY. (Pol) Sylwan 101(7): 22-39. July 1957. 99.8 Sy52

4950. Bac, S. WATER DRAINAGE IN FORESTRY. (Pol) Sylwan 101(7): 1-15. July 1957.
99.8 Sy52

4951. Bavngaard, A. FOREST DRAINAGE. (Da) Dansk Skovior. Tidsskr. 40: 394-413. Sept. 1955.
99.8 D23

4952. Bogdanov, P. L. LIMING AS A METHOD OF COMBATING MOSSES IN FOREST STANDS ON MOSS-COVERED FELLED AREAS AND DRAINED SWAMPS. In P'yavchenko, N. I., ED. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp 116-124. Ref. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the use of lime to combat mosses in forest stands on moss-covered felled areas and drained swamps in the U.S.S.R.

4953. Budyka, S. K. HYDROTECHNICAL MELIORATION IN FORESTS. (Rus) Minsk, Izdatel'stvo AN BSSR.
97 pp. Ref. 1954. 99.74 B85

4954. Budyka, S. K. BASIC PRINCIPLES AND METHODS OF HYDROTECHNICAL RECLAMATION OF POLESYE FORESTS. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 49: 135-145. 1959. 99.9 Ak1

4955. Budyka, S. K., and Krasnik, M. G. REGULATION OF THE MOISTURE OF FOREST SOILS BY HYDRO-RECLAMATION MEASURES. (Rus) In Minsk. Belorusskii Tekhnologicheskii Institut. POVYSHENIE PRODUCTIVNOSTI LESOV ZAPADNYKH ITSENTRAL'NYKH RAIONOV SSSR. pp 70-77. 1962.
99.45 M662

4956. Bush, K. K. FOREST DRAINAGE IN LATVIAN S.S.R. (Rus) Lesn. Khoz. 4: 8-11. Apr. 1963.
99.8 L5622

4957. Chertovskoi, V. G. AFFORESTATION OF FELLED AREAS OVERGROWN WITH POLYTRICHACEOUS MOSSES. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp 125-128. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the use of drainage and tillage for the afforestation of swamp soils overgrown with polytrichaceous mosses since felling of the former forested area in the U.S.S.R.

4958. Dubakh, A. D. COMBATING SWAMP FORMATION ON FOREST STANDS AFTER HEAVY CLEAR FELLINGS.
29 pp. Ref. Transl. 13756.
Translation from Leningrad. Tsentral'nyl Nauchno-Issledovatel'skii Institut Lesnogo Khozyaistva. Doklady, pp 5-38. 1963.

A report was given on the use of drainage and other methods to combat swamp formation in forest stands in the U.S.S.R. after heavy clear fellings.

4959. Elepat'evskii, M. P. CERTAIN RESULTS OF INVESTIGATIONS IN THE FIELD OF [FOREST] DRAINAGE. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 31: 35-48. 1955. 99.9 Ak1

4960. Formin, A. S. TO THE PROBLEM OF FOREST DRAINAGE IN MESHCHERA LOWLAND. (Rus) Lesn. Zhur. 5: 30-32. 1963. 99.8 Iz8

4961. Forsbacka, M. CARE OF DRAINED FOREST SOIL. (Sw) Skogsbruket 31(12): 313-315. 1961.
99.8 Sk59

4962. Gavrilov, I., and Brik, M. COMBINING FOREST DRAINAGE WORK WITH CONSTRUCTION OF ROADS. (Rus) Lesn Promysh. 11: 20-22, map. Nov. 1963. 99.82 L56

4963. Gorinskii, V. N., and Yakubovich, L. V. DRAINAGE OF FOREST MARSHES IN NORTH EUROPEAN COUNTRIES. (Rus) Lesn. Khoz. 6: 87-91. June 1964. 99.8 L5622

4964. Gurtsev, I. P. ON DRAINAGE OF FOREST AREAS. (Rus) Lesn. Khoz. 9(3): 12-15. Mar. 1956.
99.8 L5622

4965. Gurvich, I. I., and Golovin, M. M. GENERALIZATION OF THE LEADING PRACTICES OF THE FOREST CONSERVATION STATIONS. (Rus) Leningrad, Tsent. Nauch.-Issled. Inst. Lesn. Khoz. 1956(1): 4-58. Ref. 1956. 99.9 L544D

4966. Gustafsson, Y. THE WATER BALANCE PROBLEM IN AGRICULTURE AND FORESTRY. (Sw) Jord-Groda-Djur 14: 31-36. 1958. 11 J763

4967. Haveraaen, O. REFORESTATION ON MARSH. (No) Norsk Landbr. 10: 22-23, 52. May 10, 1963. 11 N8122

4968. Heikurainen, L. CHANGES IN DEPTH AND TOP WIDTH OF FOREST DITCHES AND THE MAINTAINING OF THEIR REPAIR. (Fi) Acta Forest. Fenn. 65(5): 1-45. Ref. 1957. 99.9 F492
English summary.

The changes in depth and top width of forest ditches in Finland were discussed. Recommendations for maintenance and repair were given. The changes in top width was relatively smaller than the changes in depth. A dense net of flat feeder drains was more economical than a net of deep and scattered ones. The drains serving as outlets and for run-off should be dug considerably deeper than the feeder drains.

4969. Heidurainen, L. POSSIBILITIES FOR FOREST DRAINAGE IN FINLAND. (Fi) Metsataloudellinen Aikakauslehti 12: 439-442. 1960. 99.9 F49
English summary.

A report was given on the need of draining of about 11.3 million acres of peat and mineral soils for forest production in Finland. This could be accomplished in 30 to 50 years and would increase the growth of Finnish forests by about 11 million cubic meters.

4970. Heikurainen, L. SWAMP FORESTRY RESEARCH IN FINLAND. Silva Fenn. 108(1): 1-21. Ref. 1961. 99.9 F497

A partial review of the literature was given on swamp forestry research in Finland.

4971. Henman, D. W. EFFICIENCY IN FOREST DRAINAGE. Soc. Foresters Gt. Brit. Rpt., 3d Discuss. Mtg.: 28-32. 1963. 99.9 So123

A report and discussion were given on the need, design, use, and construction of forest drainage in Great Britain.

4972. Holstener-Jorgensen, H. FORESTS AND GROUNDWATER. II. (Da) Dansk Skovfor. Tidsskr. 47(4): 158-170. Apr. 1962. 99.8 D23

4973. Huikari, O. DRAINAGE OF SWAMP LANDS FOR FORESTRY PURPOSES IN FINLAND. J. Forestry 57 (2): 128-129. Feb. 1959. 99.8 F768

An illustrated report was given on the construction and use of drainage of swamp lands in forested areas of Finland.

4974. Huikari, O. RESULTS OF A REGIONAL STUDY MADE IN THE UNDEREMPLOYMENT AREA OF EASTERN BOTHNIA. (Fi) Metsataloudellinen Aikakauslehti 3: 85-88. 1959. 99.9 F49
English summary.

4975. Kalnyn'sh, A. I. CERTAIN PROBLEMS IN ORGANIZING EXCAVATION WORK IN FOREST DRAINAGE. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 31: 248-260. 1955. 99.9 Ak1

4976. Kalnyn'sh, A. Y. MAJOR MEASURES FOR GUARANTEEING ECONOMIC RESULTS OF CONSTRUCTED FOREST DRAINAGE SYSTEMS. (Rus) Akad. Nauk Latviiskoi SSR. Inst. Lesokhoz. Prob. Trudy 22: 131-137. 1961. 99.9 R44

4977. Kirwald, E. DRAINAGE IN FORESTRY ESTABLISHMENTS. (Ge) Allg. Forstz. 14(10): 210-212. Mar. 7, 1959. 99.8 AL52.

4978. Kliavin'sh, I. I. THE INTENSIVENESS OF FOREST DRAINAGE IN LATVIAN SSR. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 49: 69-74. 1959. 99.9 Ak1

4979. Kozel, J. TEN YEARS OF THE VYZKUMNY USTAV MELIORACI. (Cz) Lesn. Prace 43(12): 564-566. Dec. 1964. 99.8 L56

4980. Kubyshkin, P. P. AGRICULTURAL SOIL IMPROVEMENT AND SILVICULTURE. (Rus) Moskva, Kolos. 334 pp. 1964. 54 K952

4981. Larsen, N. J. FOREST DRAINAGE. (Da) Dansk Skovfor. Tidsskr. 41: 223-230. Apr. 1956. 99.8 D23

4982. Lindberg, K. FOREST DRAINAGE IN THE PRACTICE. (Sw) Grundforbattring 11(4): 225-248. 1958. 54.8 G92

4983. Lindberg, K. FOREST DRAINAGE IN THE PRACTICE. (Sw) Grundforbattring 12(1): 55-61. (Cont.) 1959. 54.8 G92

4984. Lukkala, O. J. SOIL IMPROVING SUBSTANCES AND FERTILISERS AS AN AID TO FOREST DRAINAGE. (Fi) Metsataloudellinen Aikakauslehti 8: 273-276. 1955. 99.9 F49
English summary.

Experiments of the Forest Research Institute of Finland were reviewed that showed the value of soil improving substances (sand, clay and lime) and fertilizers to aid drainage on swamps where drainage alone did not give satisfactory growth. Potash and phosphorous fertilizers gave a considerable increase of tree growth in swamps with poor nutritive properties.

4985. Lukkala, O. J. ON SWAMPS AND FOREST DRAINAGE WORK IN FINLAND. Finn. Paper & Timber 9(9): 99-101. 1956. 302.8 F49

A report on forest drainage in Finland was given that included the following: (1) Brief history; (2) selection of swamps for drainage; (3) the technique of drainage; and (4) the results of drainage.

4986. Lunden, B. FOREST DRAINAGE IN VARMLAND. (Sw) Skogen (Stockholm) 46(10): 218-219. May 15, 1959. 99.8 Sk51

4987. Maki, T. E. DRAIN A FOREST? Res. & Farming [N. C. Sta.] 15(3): 14. Winter 1957. 100 N81R

A discussion was given on the economics of draining forests in North Carolina.

4988. Malek, J. THE DRAINAGE AND REFORESTATION OF WATERLOGGED ELEVATIONS. (Cz) Lesn. Prace 43(9): 399-404. Sept. 1964. 99.8 L56

4989. Merikhein, A. I. DRAINAGE OF FOREST LANDS IN ESTONIAN S.S.R. (Rus) Akad. Nauk Latviiskoi SSR. Inst. Lesokhoz. Prob. Trudy 22: 15-19. 1961. 99.9 R44

4990. Meshechok, B. DRAINAGE AND FERTILIZING OF MARSHES IN FINLAND. (Sw) Tidsskr. f. Skogbruk 71(41): 266-290, map. 1963. 99.8 T432

4991. Meshechok, B. GROWING FORESTS ON POOR MARSHLAND. (No) Ostfold Skogselsk. Arsberet. 1963: 26-36. 1964. 99.9 Os73B

4992. Meshechok, B. FOREST PLANTING IN FOREST FURROWS ON MARSHES LESSENS FROST INJURIES TO PLANTED TREES. (No) Skogeleren 51(3): 10-12. Mar. 1964. 99.81 Sk5

4993. Mikhovich, A. I. SOME QUESTIONS OF FOREST DRAINAGE IN THE UKRAINE. (Rus) Lesn. Khoz. 1962(6): 25-28. June 1962. 99.8 L5622

4994. Moller, C. M. FOREST DRAINAGE. (Da) Dansk Skovfor. Tidsskr. 41: 129-130. Mar. 1956. 99.8 D23

4995. Niskanen, M. PRICING OF MECHANICAL FOREST DRAINAGE AND CIRCUMSTANCES INFLUENCING IT. (Sw) Skogsbruket 33(3): 65-68. 1963. 99.8 Sk59

4996. Numminen, E. A STUDY ON THE DIMENSIONS AND CONDITION OF PLOUGHED FOREST DITCHES. (Fi) Metsa Taloudellinen Aikakauslehti 8/9: 282-286. 1958. 99.9 F49
English summary.

The dimensions and the conditions of plowed forest ditches in Finland were given 1 to 5 years after their construction.

4997. Numminen, E. THE FACTORS DETERMINING THE DIFFICULTY OF FOREST DITCH PLOUGHING IN THE LIGHT OF CONTEMPORARY CONDITIONS. (Fi) Suo 11(3): 45-50. Oct. 15, 1960. 54.8 Su7
English summary.

A report was given on the factors influencing forest ditch plowing in Finland.

4998. Obminski, Z. ABOUT WATER RELATIONS IN FORESTS AND THE NATURAL BASES OF THEIR REGULATION. (Pol) Sylwan 107(4): 11-18. July/August 1963. 99.8 Sy52
English summary.

A discussion was given on the effect of water relations in forests in Poland by the use of drainage and irrigation and the need for a better classification of forests from the standpoint of their water relations. Additional research on water relations and their management in forests in Poland was recommended.

4999. Odins, J. J. FOREST DRAINAGE (La) Riga, Latvijas valsts izdevnieciba. 282 pp. 1960. 54 Od3

5000. Ostroumov, S. ON RECLAMATION OF THE TAIGA FOR AGRICULTURAL LAND. (Rus) Sel'sk. Khoz. Sibiri 1957(3): 21-26. Mar. 1957. 20 Se492

5001. Ostrowski, S. PROBLEMS OF WATER MANAGEMENT IN FORESTS. (Pol) Las Polski 38(5): 4-5, 9. Mar. 1/15, 1964. 99.8 L33

5002. P'iavchenko, N. I. TYPOLOGICAL CHARACTERISTICS OF MARSH-RIDDEN FORESTS FOR PURPOSES OF RECLAMATION THROUGH DRAINAGE. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 49: 9-16. 1959. 99.9 Ak1

5003. P'iavchenko, N. I., and Kozlovskaia, L. S. FOREST BOG STUDY AND DRAINING MELIORATION IN FINLAND. (Rus) Vest. Sel'skokhoz. Nauki 4(4): 120-125. Apr. 1959. 20 V633
English summary.

A report was given of the conditions of scientific and practical work on the study of bogs and the drainage and reclamation of bogged lands in Finland. Various types of ditch digging equipment were described and illustrated.

5004. Pinchuk, M. G. FOREST DRAINAGE IN THE USSR. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 49: 5-8. 1959. 99.9 Ak1

5005. Pinchuk, M. G. DRAINING OF FORESTS IN THE USSR. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp. 3-6. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A report was given on the need and use of drainage of forests in the U.S.S.R.

5006. Polli, L. A. FOREST-DRAINAGE WORK IN ESTONIA. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 49: 75-81. 1959. 99.9 Ak1

5007. Polli, L. A. FOREST DRAINAGE PROJECTS IN ESTONIA. In P'yavchenko, N. I., ed. THE INCREASE OF PRODUCTIVITY OF SWAMPED FORESTS. pp 77-83. 1963. 99.556 P57
Translation from Povyshenie produktivnosti zabolochennykh lesov. Materialy soveshchaniya.

A discussion was given of forest drainage projects in Estonia.

5008. Poncet, A. FOREST ROADS AND EROSION IN MOUNTAINS. (Fr) Rev. Forest Franc. 16(4): 267-285. Ref. Apr. 1964. 99.8 R329

5009. P'yavchenko, N. I. FOREST SWAMP SCIENCE AND FOREST LAND DRAINING IN THE USSR. In Akademiya Nauk SSSR. VOPROSY LESOVEDENIYA I LESOVODSTVA. pp. 294-299. 1960. 99.34 Ak13

A report was given on forest swamp science and forest land draining in the U.S.S.R.

5010. P'yavchenko, N. I. WAYS FOR INCREASED PRODUCTIVITY OF SWAMPED FORESTS OF SIBERIA. (Rus) Nauch. Konf. Posvyashchennaya Izuch. Lesov. Sibiri i Dal'nego Vostoka. Trudy Konf. 1962: 225-232. 1963. 99.9 N222.

5011. Romanov, V. V., and Ivanov, K. E. WATER BALANCE OF THE VALLEY MARSHES OF THE WOODLAND AND ITS POSSIBLE TRANSFORMATION. (Rus) In KONFERENTSIIA PO MELIORATSII I OSVOENIIU BOLOTNYKH I ZABOLOCHENNYKH POCH, 1955. Trudy, Minsk. pp. 217-231. 1956. 54.9 K83

5012. Sabo, E. D. ECONOMIC EFFECTIVENESS OF THE DRAINAGE OF FOREST AREAS IN LATVIAN S. S. R. (Rus) Akad. Nauk Latviiskoi SSR. Inst. Lesokhoz. Prob. Trudy 22: 177-182. 1961. 99.9 R44

5013. Sabo, E. D. ADVANCED EXPERIENCE IN FOREST DRAINAGE. (Rus) Lesn. Khoz. 1: 27-32. Jan. 1963. 99.8 L5622

5014. Sakovich, A. E. WE'RE DRAINING FOREST MOUNTAIN RANGES. (Rus) Lesn. Khoz. 10(10): 69-70. Oct. 1957. 99.8 L5622

5015. Santalin, K. V. ON DRAINAGE OF FOREST AREAS. (Rus) Lesn. Khoz. 8(3): 26-28. Mar. 1955. 99.8 L5622

5016. Schlaudt, E. A. DRAINAGE IN FORESTRY MANAGEMENT IN THE SOUTH. U. S. Dept. Agr., Agr. Ybk. 1955: 564-568. 1955. 1 Ag84Y

The use of drainage in forestry management in the Southern United States was discussed.

5017. Smolyak, L. P. DRAINAGE OF SWAMPED FORESTS OF BELORUSSIA. (Rus) Lesn. Khoz. 11: 10-13. Nov. 1963. 99.8 L5622.

5018. Solli, S. SUMMER WORK IN THE FOREST. (No) Norsk Landbr. 12: 10-11. June 12, 1964. 11 N8122.

5019. Sozykin, N. F. WORK OF THE VSESOIUZNYI NAUCHNO-ISSLEDOVATEL'SKII INSTITUT LESOVODSTVA I MEKHANIZATSII LESNOGO KHOZIAISTVA [ALL-UNION SCIENTIFIC-RESEARCH INSTITUTE OF FORESTRY AND MECHANIZATION OF THE FOREST INDUSTRY] ON FOREST DRAINAGE. (Rus) Akad. Nauk SSSR. Inst. Lesa. Trudy 49: 89-93. 1959. 99.9 Ak1

5020. Stoeckeler, J. H. A REVIEW OF FOREST SWAMP DRAINAGE METHODS IN NORTHERN EUROPE. J. Forestry 61(2): 99-104. Ref. Feb. 1963. 99.8 F768

A review of the literature was given of the drainage of peatlands and wet mineral forested soils in northern Europe.

5021. Stubbs, J. A CHALLENGING OPPORTUNITY IN FOREST MANAGEMENT: WETLAND FORESTS. Forest Farmer 21(11): 6-7, 10-13. July 1962. 99.8 F7692

A report was given on the use of drainage and other methods of silviculture for managing the wetland forests in the Southeastern Coastal Plains.

5022. Tanttu, A. THE PROFITABILITY OF SWAMP DRAINAGE FOR FORESTRY PURPOSES. (Fi) Metsataloudellinen Aikakauslehti 1: 27-30. 1956. 99.9 F49
English summary.

The value of open ditches and covered ditches for the drainage of swamps for forestry purposes was given. Ways to reduce the costs by using mechanization were reported.

5023. Wallis, J. R. LOGGING FOR WATER QUALITY IN NORTHERN CALIFORNIA. U. S. Forest Serv. Res. Note PSW-N23, 7 pp. 1963. 1.9 F762R

Land managers have developed these important rules for logging while preserving water quality: (1) Plan landings, roads, and skid trails so that they are not in the creekbeds and washes; (2) install adequate cross-drainage on all temporary roads and skid trails before moving to the next logging area; (3) remove temporary fills and drainage structures in water channels before leaving a logged area; (4) keep damaging traffic off unsurfaced roads that are soft; (5) repair and clean out all drainage ditches, dips, and culverts at least every fall; (6) compact big fills during road construction; (7) keep road fills and logging debris out of creeks; (8) keep bulldozers off steep slopes; (9) never construct upside-down fills (surface soils and slash underneath and rock on top); (10) see that all permanent roads have adequate drainage for surface and sub-surface water; and (11) use logging systems that minimize soil disturbance and road construction.

5024. Zaborovskii, E. P., Lisin, S. S., and Sobolev, S. S. SILVICULTURE AND FOREST DRAINAGE. (Rus) Moskva, Lesnaya Promyshlennost'. 392 pp. 1964. 99.45 Z12L

SEE ALSO--114, 256, 891, 1116, 1186, 1195, 1206, 1363, 1472, 1605, 1696, 1703, 1751, 1842, 1884, 1980, 1981, 1992, 2097, 2104, 2130, 2160, 2165, 2185, 2193, 2455, 2472, 2495, 2500, 2501, 2526, 2549, 2582, 2587-2589, 2603, 2614-2622, 2629, 2631, 2634-2636, 2651, 2652, 2659, 2660, 2671-2673, 2682, 2683, 2692, 2693, 2697, 2705, 2724, 2739, 2745, 2751, 2752, 2756, 2757, 2774, 2785-2787, 2799, 2821, 2822, 2829-2834, 2836-2840, 2848, 2853, 2882, 2883, 2885, 2886, 2891, 2911, 2912, 2949-2951, 2954-2956, 2960, 2982, 2987, 2990, 3000, 3004, 3077, 3192, 3246, 3705, 3849, 4099, 4106, 4162, 4188, 4197, 4217, 4227, 4239, 4257, 4283, 4285, 4287, 4300, 4329, 4332, 4333, 4342, 4353, 4355, 4369, 4373, 4374, 4390, 4391, 4414, 4566, 4567, 4578, 4599, 4607, 4763, 4836, 4858, 4860, 4861, 4881, 4891, 4895, 4911, 4935, 4937.

Interception Drainage

5025. Ayyar, L. V., and Venkataraman, A. R. RECLAMATION OF WATERLOGGED AND MARSHY LAND IN COLLAIR LAKE BASIN. Cong. Irrig. & Drain. Trans. 4(3): 11.549-11.563, maps. 1960. 55.9 C7652

A report was given of the reclamation of waterlogged and marshy land in the Collair Lake Basin in India by the use of detention reservoirs and diverting where feasible, the upland streams to the adjoining valleys.

5026. Blewitt, R. I. DIVERSION DITCHES ON SUGAR CANE LANDS IN HAWAII. I. World Farming 4(5): 26-28, 38-39. (Cont.) May 1962. 30.08 W89

An illustrated report was given on the construction and use of diversion ditches for sugar-cane in Hawaii.

5027. Brower, F. R. DIVERSION TERRACES FOR EROSION CONTROL AND DRAINAGE. ASAE 3(1): 73-74. 1960. 290.9 Am32T

A report was given on the use of diversion terraces for erosion control and drainage in Pennsylvania.

5028. Carder, D. G. DAMS. West. Austral. Dept. Agr. J. (ser. 4)2(10): 859, 862. Oct. 1961. 23 W52J

A report was given on the use of dams in Australia. The use was given for contour banks (terraces), diversion banks (diversion terraces), and contour drains to divert water to an ideal site for a dam.

5029. Davison, D. N., and King, V. G. SAVING AND USING THE RUNOFF. Soil Conserv. 26(9): 214-215. Apr. 1961. 1.6 So3

A report was given on the use of clay tile to drain a wet meadow and carry water from springs to irrigation reservoirs. Water from winter runoff was also diverted to the reservoirs.

5030. Foote, M. V. DIVERSION DRAINS. Queensland Fruit & Veg. News 11(1): 22-23. Jan. 3, 1957. 280.38 Q3

A report was given on diversion drains in Australia.

5031. Houston, C. E. DRAINAGE. In California University Extension Div. FARM MANAGEMENT SEMINAR FOR BANK OF AMERICA OFFICERS. Davis. pp. 54-62. 1959. 281.12 C12

A discussion was given of drainage needs and practices in California. Relief and interceptor drainage were discussed. Tile drainage, open ditches, and drainage of wells were described.

5032. Ice, P. W. CONSERVATION IS HELPING FAMILY TO $500,000 ORCHARD INCOME GOAL. Soil Conserv. 29(2): 27-28. 1963. 1.6 So3S

A report was given on the use of diversion terraces to provide pond water for irrigation of orchards in southern Illinois.

5033. Kano, T. METHOD OF DEPRESSING WATER LEVEL BY DRAINAGE CANALS IN LOW SWAMPY LAND. Cong. Irrig. & Drain. Trans. 4(3): 11.577-11.620, map. 1960. 55.9 C7652

A report was given on the method of using drainage canals in low swampy land in Japan to divert water entering the low area so that a proper drainage system can be installed in the area.

5034. Ladewig, J. E. THE CATCHMENT APPROACH TO SOIL CONSERVATION. Aueensland Agr. J. 86(11): 659-662. Nov. 1960. 23 Q33

A report was given on the group approach to catchment areas of farming in Australia to control erosion and divert and store water for future use.

5035. Mayo, K. L. ARRANGEMENT OF TILE DRAINPIPES TO DIVERT SPRING INTO DRAINAGE SYSTEM. New Zealand J. Agr. 99(2): 138. Aug. 15, 1959. 23 N48J

A report was given on methods used to divert a spring into a tile drainage system in New Zealand.

5036. Rao, M. S. V. R. BIJAPUR CONTOUR BUNDING. Indian Forester 81: 627-645. Oct. 1955. 99.8 In2

A report was given on the use of contour bunding (type of diversion terrace) in India. Both dirt and stone terraces have been used from time immemorial.

SEE ALSO--65, 1555, 1636, 1641, 1659, 1663, 1681, 1732, 1754, 1763, 1774, 1838, 1848, 1912, 1955, 1956, 1971, 1972, 2014, 2088, 2117, 2175, 2196, 2278, 2327, 2331, 2370, 2420, 2540, 2896, 3006, 3016, 3027, 3032, 3053, 3067, 3085, 3111, 3149, 3158, 3161, 3183, 3263, 3266, 3301, 3303, 3372, 3770, 3784, 4041, 4738.

Mosquitoes and Wildlife

5037. Allen, D. L. DAMS, DRAINAGE, AND SOME FACTS OF LIFE. Forest Notes 47: 17-18. Fall 1955. 99.9 F7691

A report was given against the use of dams and drainage for reclaiming new lands in the United States.

5038. Anonymous. BATTLING THE MOSQUITOES. Reclam. Era 48(2): 35-37. May 1962. 156.84 R24

A report was given on an inter-agency committee study on mosquito control in the Western United States.

5039. Brockway, P. B. WATER MANAGEMENT IN MARSH AREAS FOR MOSQUITO CONTROL AND THE CONSERVATION OF WILDLIFE. Mosquito News 20(3): 235-237. Sept. 1960. 421 M85

A report was given on the use of water management by open ditches and pumping in Ohio to control mosquitoes but not affect the wildlife in the marsh area.

5040. Brown, M. V. EXPERIENCE WITH DISTRICT-OWNED SOURCE REDUCTION EQUIPMENT. Calif. Mosquito Control Assoc. Proc. & Papers, 31: 67. 1963. 428 C763

A report was given on the use of district owned equipment for reducing mosquitoes in California.

5041. Burwell, R. W., and Sugden, L. G. POTHOLES--GOING, GOING--. In U. S. Fish and Wildlife Serv. Bur. of Sport Fisheries and Wildlife. WATERFOWL TOMORROW. pp. 369-380. 1964. 156.21 W29

A discussion was given on the fffect of drainage of pothole areas on waterfowl in the United States.

5042a. Carhart, A. H. DIG THAT SWAMP! Nat. Mag. 50(7): 344-348, 387. Aug./Sept. 1957. 409.6 N214

A report was given on the effects of drainage of swamp areas on wildlife and the conflict of interest between drainage and wildlife.

5042b. Carmichael, G. T. EFFECTIVENESS OF DITCHING IN CONTROLLING SALT-MARSH MOSQUITOES. Fla. Anti-Mosquito Assoc. Rpt. Annu. Mtg. 28: 80-82. 1957. 420 F663

A report was given on the effectiveness of ditching or controlling salt marsh mosquitoes in Florida.

5043. Catts, E. P., Lesser, F. H., Darsie, R. F., Florschutz, O. and Tindall, E. E. WILDLIFE USAGE AND MOSQUITO PRODUCTION ON IMPOUNDED TIDAL MARSHES IN DELAWARE, 1956-1962. N. Amer. Wildlife & Nat. Resources Conf. Trans. 28: 125-132. 1963. Ref. 412.9 N814

Long time studies evaluating the effect of salt marsh impounding on mosquito production and wildlife usage in Delaware indicated that the marsh water level was the important factor. Moderate water levels of 9 to 12 inches in depth were compatible both with low mosquito production and high wildlife usage.

5044. Compiano, F. A. HOW WE CAN IMPROVE OUR SOURCE REDUCTION PROGRAMS. Calif. Mosquito Control Assoc. Proc. & Papers 31: 70-71. 1963.

A discussion was given on ways to improve the mosquito source reduction programs in California.

5045. Davis, S. MOSQUITO CONTROL PROBLEMS OF THE IRRIGATOR. Mosquito News 19(2): 68-69. 1959. 421 M85

A discussion was given on the control of mosquitoes in Montana by the correct amount of irrigation water and fertilizer.

5046. Davis, S. SOIL, WATER AND CROP FACTORS THAT INDICATE MOSQUITO PRODUCTION. Mosquito News 21(1): 44-47. 1961. 421 M85

A combination of factors is required to produce mosquitoes; the rating table presented pointed out the problem factors. Use of information from irrigation guides, land leveling, and attention to all items involved can reduce mosquito-breeding sites.

5047. Davis, S. and Schumaker, G. LIGHT IRRIGATION, USE OF FERTILIZER RESULTS IN PRODUCTION OF MORE BLUEJOINT HAY, FEWER MOSQUITOES. Mont. Farmer-Stockman 46(18): 55. 1959. 6 M764

A report was given on the use of fertilizers and less irrigation water by flooding to produce more hay and less mosquitoes in Montana.

5048. Davis, S., and Schumaker, G. A. IRRIGATION PRACTICES FOR INCREASING CROP PRODUCTION AND MOSQUITO CONTROL. Trans. ASAE 4(1): 21-23. 1961. 290.9 Am32T

Irrigation-caused mosquito problems tend to be acute in areas having plentiful water supplies, little slope, and low-intake-rate soils devoted to the production of low income crops such as native hay. All of these conditions exist in the Milk River Valley of Montana. Cooperative studies were conducted in this valley by the U. S. Public Health Service and the Montana Agricultural Experiment Station to develop procedures that would improve these undesirable conditions.

It was concluded that use of suggested crops, nitrogen fertilizer, and frequent, light irrigations will help increase per-acre income and reduce mosquitoes.

5049. Day, A. M. DRAINAGE IN RELATION TO SOIL BANK PROGRAM. Internatl. Assoc. Game, Fish & Conserv. Comnr. Conv. 47: 102-107. 1957. 412.9 In8

A report was given on the effect of the soil bank program on draining wetlands as it conflicts with wildlife interests.

5050. Dillon, O. W. WILDLIFE AND WATER CONSERVATION IN TEXAS. Tex. J. Sci. 10(3): 353-357. Sept. 1958. 470 T31

A report was given on the inter-relationships of wildlife and water conservation in Texas.

5051. Ferrigno, F. VARIATIONS IN MOSQUITO-WILDLIFE ASSOCIATIONS ON COASTAL MARSHES. N. J. Mosquito Extermin. Assoc. Proc. 48: 193-203, maps. 1961. 420 N46

A report was given on the mosquito-wildlife association on coastal marshes in New Jersey. There was a close relationship between high marsh utilization by wildlife and lack of mosquito breeding. The species Aedes breed in the marshes while the species Cules and Anopheles breed in stagnant water.

5052. Firman, M. SOIL PROBLEMS AS THEY AFFECT MOSQUITO ABATEMENT DISTRICTS. Calif. Mosquito Control Assoc. Proc. & Papers 28: 75-79. 1960. 428 C673

A discussion was given on the effect of soil problems and irrigation problems on mosquito control in mosquito abatement districts in California.

5053. Helm, R. W., Taylor, W., Henderson, W. D., and Conant, V. WATER MANAGEMENT, CORNER-STONE OF NEW JERSEY MOSQUITO CONTROL. N. J. Mosquito Extermin. Assoc. Proc., Annu. Mtg. 50: 129-132. 1963. 420 N46

A report was given on the value of water management of salt marshes in New Jersey by eliminating breeding places of mosquitoes by drainage and filling in of marshes.

5054. Hopkins, R. C. DRAWDOWN FOR DUCKS. Wis. Conserv. B. 27(4): 18-19. 1962. 279.8 W752

Draw down the water level in the spring and the waterfowl pond, flowage, or marsh will be much more attractive to ducks in the autumn because of the food plants which will volunteer in the drained area. The area can then be reflooded in late August or early September.

The drawdown management practice is being used all over Wisconsin on many State-owned areas and on a number of private waterfowl areas. By lowering and raising water levels, plant succession can be controlled to bring about production of the kinds of foods waterfowl and many other wildlife species like most.

5055. Horlings, A. THE WAR AGAINST DRAINAGE. Land Impr. 3(11): 7-8. Nov. 1956. 282.8 L224

A report was given of the fight against drainage of wetlands important to waterfowl. It was proposed that all ACP payments for drainage, plus much SCS technical help, be stopped. Comments both for and against drainage were given.

5056. Horlings, A. ANTI-DRAINAGE CAMPAIGN COULD SLOW THE WHOLE CONSERVATION, WATERSHED PROGRAM. Land Impr. 5(4): 16, 28. Apr. 1958. 282.8 L224

A report was given on the effects of the anti-drainage campaign, especially as it affects wildlife, on the conservation and watershed programs.

5057. Janzen, D. H. WETLANDS AND WATERFOWL. U. S. Mo. Basin Inter-Agency Comt. Minutes Mtg. 91(app. J), 7 pp. 1956. 173 M69

A report on the effects of drainage on waterfowl was given especially as it pertains to Federal subsidizing for drainage.

5058. Johnson, H. A REPORT FROM THE WEST MILLARD MOSQUITO ABATEMENT DISTRICT. Utah Mosquito Abatement Assoc. Proc. 15: 18-19. 1962. 420 Ut1

A report was given of the problems of this mosquito district in Utah due to irrigation and drainage waters.

5059. Kadlec, J. A. EFFECTS OF A DRAWDOWN ON A WATERFOWL IMPOUNDMENT. Ecology 43: 267-281. 1962. 450 B652

The effects of a drawdown on the soil, water, vegetation, invertebrates, and populations of waterfowl of an impoundment were determined.

Soil and water analyses indicated a definite increase in plant nutrients. A marked increase in soil nitrates occurred during the drawdown as a result of aerobic nitrification. This effect persisted at least until the spring of the first year of reflooding. The response of other nutrients was less definite, but increases were noted and plant growth improved. The most favorable increase in fertility was obtained when the organic portion of the soil remained moist or even wet during the drawdown.

Invertebrate populations, a potential food supply for waterfowl, were considerably reduced after the drawdown.

5060. Kandle, R. P. DRAINAGE AND HEALTH. N. J. Dept. Health. Pub. Health News 41(12): 424-425. Dec. 1960. 449.7 N46P

A report was given on the cases of Eastern Encephalitis carried by mosquitoes that affect wild birds, tame birds, and even humans. Water management was given as the key to this mosquito carried disease.

5061. Katz, M., and Chadwick, G. C. TOXICITY OF ENDRIN TO SOME PACIFIC NORTHWEST FISHES. Trans. Amer. Fisheries Soc. 90: 394-397. 1961. 414.9 Am3

The toxicity of an endrin formulation to spring chinook and coho salmon, rainbow trout, bluegill, mosquitofish, guppies, and the marine threespine stickleback was determined at 20°C. Coho salmon were the most sensitive, with a 96-hour TL of 0.27 parts per billion endrin; sticklebacks were the most tolerant. A volume effect was demonstrated; bluegills died at lower concentrations of endrin in aquaria with the smallest number of fish. Temperature had a marked influence on toxicity of endrin to bluegills, the toxicity increasing with rise of temperature. Tolerance of endrin by marine threespine sticklebacks was about the same in waters of different salinities. Developing eggs and early larvae of the stickleback are more tolerant than fully developed fish.

5062. Kirkland, C. J. THE COOPERATIVE PLAN OF DRAINAGE AND MOSQUITO CONTROL PRACTICED IN BERGEN COUNTY. N.J. Mosquito Extermin. Assoc. Proc. 44: 125-127. 1957. 420 N46

A periodic drawdown of water in a swamp (every four years) provided a method of maximum control of the mosquito Mansonia Perturbans for a minimum of effort and expense in New Jersey.

5063. Knowlton, G. F. MOSQUITO PROBLEMS OUTSIDE OF ORGANIZED CONTROL DISTRICTS. Utah Mosquito Abatement Assoc. Proc. 15: 16-17. 1962. 420 Ut1

A report was given of mosquito problems in Utah in areas outside of organized control districts. Many of the problems are caused on the farms by water wastage, seepage from canals and irrigation ditches, and shallow water in grassy areas along streams.

5064. Lynch, R. G. DRAINAGE VERSUS DUCKS. Amer. Forests 63(2): 22-23, 58-59, 61. Feb. 1957. 99.8 F762

A report was given on the controversy of the destruction of duck habitat by subsidized drainage.

5065. McBroom, J. T. FISH AND WILDLIFE IN SMALL WATERSHEDS. J. Soil and Water Conserv. 16: 21-24. 1961. 56.8 J822

A study was reported on the effect of the Watershed Protection and Flood Prevention Act of 1954.

As watershed work plans became available for analysis, it was apparent that some of them contained water management features most favorable to fish and wildlife. Many soil conserving practices recommended also improved wildlife habitat. In other cases, measures recommended in work plans were more or less neutral in their immediate effects on fish and wildlife. These offered promise for the future in that they would provide a stable land-use base to which more specialized fish and wildlife management measures could later be applied. Only a few work plans--less than 5 percent--proposed measures that would have serious adverse effects on fish and wildlife resources, and these largely by drainage of wetlands.

5066. MacGillivray, N. A., and Husbands, R. C. PROPER IRRIGATION PRACTICES AS A METHOD OF CONTROLLING MOSQUITO SOURCES. Calif. Vector Views 4(2): 7, 11-12. 1957. 449.8 C12

In addition to chemical methods of mosquito control, source reduction, when possible, is being given an increasingly important place in abatement programs in California. Local control agencies have developed new techniques and modified or refined the time-tested methods to eliminate or reduce standing water capable of producing mosquitoes. Emphasis was placed for the most part on surface drainage by means of specially constructed drain ditches, sumps, and return-flow irrigation pump systems. In addition, certain land management methods such as surface releveling, slope correction, or soil treatment to increase infiltration or to reclaim alkali land were sometimes recommended. Each of these practices has its proper place in mosquito control operations.

5067. Manson, P. W. WETLANDS, WILDLIFE AND MODERN FARMING. Land Impr. 5(4): 11-12. Apr. 1958. 282.8 L224

Scientific opinion was given that drainage is not dooming our wildlife and drying up our wells. The author concluded that the time has come to be realistic about wildlife programs that involve privately-owned potholes and other types of shallow wetlands in the rich farming areas of our country.

5068. Manville, R. H. A POSSIBLE PEST ON DITCH-BANKS: NUTRIA. Reclam. Era 50(3): 66-67, 74, map. Aug. 1964. 156.84 R24

A report was given on the nutria as a possible pest in drainage canals and irrigation ditches.

5069. Mulhern, T. D. VARIED MANIFESTATIONS OF MOSQUITO SOURCE REDUCTION IN CALIFORNIA. Calif. Mosquito Control Assoc. Proc. & Papers 28: 80-82. 1960. 428 C673

A discussion was given of the many kinds of projects used for mosquito source reduction by mosquito abatement districts in California.

5070. Myers, L. E., Jr. IRRIGATION EFFICIENCY AND MOSQUITO PRODUCTION. Mosquito News 16(2): 133-136. June 1956. 421 M85

The relationship between mosquito production and the efficiency of irrigation and water use practices offers us the opportunity to develop a powerful weapon for use in combatting irrigation-caused mosquito problems. This opportunity is not in itself, however, an answer to our problems. We will obtain the answers we need only through intelligent planning, wholehearted cooperation, and hard work.

5071. Pickering, Q. H., Henderson, C., and Lemke, A. E. THE TOXICITY OF ORGANIC PHOSPHORUS INSECTICIDES TO DIFFERENT SPECIES OF WARMWATER FISHES. Trans. Amer. Fisheries Soc. 91: 175-184. 1962. 414.9 Am3

Bioassays were conducted with 13 organic phosphorus insecticides to determine their relative toxicity to 4 species of fish. An extremely wide range in toxicity was found with 96-hour TLm (median tolerance limit) values ranging from 0.0052 to 610 p.p.m. Bluegills were generally the most sensitive fish, followed by guppies, fathead minnows, and then goldfish. The maximum sensitivity of the different species to particular compounds ranged from 4 to as high as 900 times the minimum. Additional experiments were conducted with some of the compounds. Larger bluegills (10 grams) were slightly more tolerant than smaller bluegills (2 grams) to Delnav, parathion, and malathion; green sunfish of similar size and largemouth bass (5 grams) were not greatly different in sensitivity from the larger bluegills. Tests of five compounds revealed that the toxicity of emulsible concentrates or wettable powders was similar to that of the technical grade material. Fathead minnow fry from 2 to 30 days old were about 10 times as sensitive to Delnav as adults.

5072. Rees, D. M. THE DEVELOPMENT OF TECHNIQUES FOR MULTIPURPOSE MANAGEMENT OF REUSABLE WATER BEFORE IT ENTERS THE GREAT SALT LAKE. Utah Mosquito Abatement Assoc. Proc. 15: 1-2. 1962. 420 Ut1

A report was given on the management of waste irrigation water in Utah for "source reduction" of mosquitoes for the multipurpose management of reusable water in Utah.

5073. Ruber, E., and Jobbins, D. M. SOME EFFECTS OF MOSQUITO LARVICIDES ON SALT MARSH MICRO-ORGANISMS. N. J. Mosquito Extermin. Assoc. Proc. 48: 159-163. 1961. 420 N46

A report was given on some effects of mosquito larvicide on salt marsh micro-organisms on some diked marshes in New Jersey.

5074. Santovito, D., and Venezia, F. PARTICULAR ASPECTS OF THE HYDRAULIC RECLAMATION IN THE DISTRICT OF BRINDISI. Cong. Irrig. & Drain. Trans. 5(6): R.18.168-R.18.168L. 1963. 55.9 C7652

A report was given on drainage problems in the district of Brindisi, Italy.

5075. Scharff, J. W. ANTI-MALARIAL DRAINAGE FROM THE POINT OF VIEW OF THE HEALTH OFFICER. Malaya. Malaria Adv. Bd. C. 10, rev., 53 pp. Nov. 1959. 448.9 M293

A report was given on the value of drainage for mosquito control in Malaya.

5076. Schrader, T. A. WATERFOWL AND THE POTHOLES OF THE NORTH CENTRAL STATES. U. S. Dept. Agr., Agr. Ybk. 1955: 596-604. 1955. 1 Ag84Y

A report was given on the conflict of drainage of cropland and waterfowl production in the pothole areas of Minnesota, North Dakota, South Dakota, and Iowa.

5077. Shaeffer, J. H. AGRICULTURAL PRESSURES AND THE IMPACT OF FEDERAL SUBSIDIES ON THE DRAINAGE OF SOUTH DAKOTA WETLANDS. S. Dak. Conserv. Digest 22(9): 2-4. Sept. 1955. 412.9 So822

A report was given on the conflict of wildlife and drainage on South Dakota wetlands especially as it applies to the impact of Federal subsidies for drainage.

5078. Shaw, S. P., and Crissey, W. F. WETLANDS AND THE MANAGEMENT OF WATERFOWL. U. S. Dept. Agr., Agr. Ybk. 1955: 604-614. 1955. 1 Ag84Y

A report was given on the management of wetlands for waterfowl. A wetland inventory was given to serve as a guide for selecting areas where waterfowl values should be given top consideration. The conflict of interest was stressed between drainage for crop production and the production of waterfowl.

5079. Shaw, S. P., and Fredine, C. G. WETLANDS OF THE UNITED STATES; THEIR EXTENT AND THEIR VALUE TO WATERFOWL AND OTHER WILDLIFE. U. S. Fish & Wildlife Serv. C. 39, 67 pp. 1956. 156.2 C49

A report was given on the extent and value of the wetlands in the United States for waterfowl and other wildlife. The conflict of interest on wildlife and drainage was discussed.

5080. Silveira, S. M. MINIMIZING MOSQUITO PRODUCTION ON SEWER FARMS BY PROPER PLANNING. Calif. Mosquito Control Assoc. Proc. & Papers 28: 83-84. 1960. 428 C763

A report was given on minimizing mosquito production on city sewer farms and liquid manure from dairy farms in California.

5081. Smith, D. A. THE UTAH DEPARTMENT OF FISH AND GAME-OUR TECHNIQUES AND OBJECTIVES IN MARSH DEVELOPMENT AND MANAGEMENT. Utah Mosquito Abatement Assoc. Proc. 15: 4-5. 1962. 420 Ut1

A report was given on the techniques and objectives of marsh development and management for wildlife production and mosquito control in Utah.

5082. Smith, D. A. UTAH'S STATE-OWNED MARSH LANDS; THEIR ROLE IN THE PERPETUATION AND USE OF RESOURCE. Utah Mosquito Abatement Assoc. Proc. 16: 3-5. 1963. 420 Ut1

A report was given on the effect state-owned marshlands have on mosquitoes and wildlife in Utah.

5083. Smith, L. W. WATER MANAGEMENT ON THE SALT MARSHES OF NEW JERSEY. Mosquito News 22(2): 81-83. June 1962. 421 M85

A report was given on the use of water management of the salt marshes to control mosquitoes in New Jersey. The following methods were tested: (1) Drainage of open salt marsh; (2) dikes and tidal gates; (3) dikes and pumps; (4) tidal outlets; (5) vertical drainage; (6) dredging and filling; (7) outlets through barrier beaches; and (8) experimental impoundment with water level and water quality control.

5084. Smith, M. W. PHOSPHORUS ENRICHMENT OF DRAINAGE WATERS FROM FARM LANDS. Canada. Fisheries Res. Bd. J. 16(6): 887-895. Ref. Dec. 1959. 442.9 C16J

A report was given on the value of phosphorus from drainage waters from farm lands as a source of fertilizer for the production of brook trout in Canada.

5085. Studholme, A. T., and Sterling, T. DREDGES AND DITCHES. In U. S. Fish and Wildlife Service Bureau of Sport Fisheries and Wildlife. WATERFOWL TOMORROW. pp. 359-368. 1964. 156.21 W29

A report was given on the effect of the reclamation of land by ditches on waterfowl in the United States and Canada.

5086. Swenson, E. A., Jr. WATERFOWL MARSH DEVELOPMENTS CATCH ON IN CONNECTICUT. Soil Conserv. 28(9): 209-210. May 1963. 1.6 So3S

A report was given on waterfowl marsh developments in Connecticut.

5087. Talbert, R. E. CONTROLLING MUSKRATS. Calif. Dept. Agr. B. 51(3): 153-156. 1962. 2 C12M

A report was given on controlling muskrats in California to prevent damage to irrigation systems and waterways.

5088. Tossett, O. USE OF WET LANDS. U. S. Mo. Basin Inter-Agency Comt. Minutes Mtg. 91 (app. K), 5 pp. 1956. 173 M69

A report was given on the use of and drainage of wetlands in North Dakota. The effects of drainage on wildlife was stressed.

5089. Walker, C. R. SIMAZINE AND OTHER S-TRIAZINE COMPOUNDS AS AQUATIC HERBICIDES IN FISH HABITATS. Weeds 12(2): 134-139. 1964. 79.8 W41

Simazine, altrazine, propazine, and prometone were tested as aquatic herbicides in fish habitats. Preemergence applications of granular formulations of simazine on attaclay or calcium sulfate of simazine at 1 to 2 p.p.m.w. controlled Potamogeton, Najas, Ceratophyllum, Heteranthera, and Zannichellia. Higher rates were required to control filamentous algae (Cladophora and Pithophora) and chara (Chara vulgaris). Early postemergence applications of wettable powder to submersed aquatics and filamentous algae were often effective. Atrazine gave similar results. Concentrations of 0.5 to 1.0 were effective in controlling Cladophora, Pithophora, and three species of Potamogeton in pond applications.

Simazine had a relatively high margin of safety with respect to acute toxicity to fish. It was less toxic than propazine, prometone, or atrazine. Granular forms were less toxic than wettable powder or emulsifiable concentrates.

5090. Weller, M. W. WHAT'S IN THAT MARSH? Iowa Farm Sci. 16(11): 10-12. May 1962. 275.28 Io94

A report was given on the vegetation and wildlife in marshes in Iowa.

5091. Whitten, G. R. DUCK MANAGEMENT FOR MOSQUITO SUPPRESSION. Calif. Mosquito Control Assoc. Proc. & Papers 31: 69. 1963. 428 C763

A report was given on the use of duck management for mosquito suppression in California.

5092. Wilson, C. S. WETLANDS VERSUS OPEN WATER DRAINAGE. Natl. Watershed Cong. (Proc.) 3: 73-84. 1956. 292.9 N212

Temporary and permanent measures to be adopted to retard drainage of wetlands because of its harmful effects on wildlife were discussed.

SEE ALSO--4, 118, 142, 1197, 1206, 1207, 1242, 1265, 1288, 1369, 1409, 1425, 1451, 1460, 1466, 1489, 1491, 1612, 1729, 1738, 1816, 1888, 2043, 2107, 2378, 2388, 2429, 2491, 2553, 2740, 2969, 3425, 3698, 3728, 3865, 3884, 3956, 4072, 4513, 4519, 4552, 4568, 4655, 4726, 4747, 4773, 4783, 4813, 4881, 4929, 4945, 5016, 5097, 5099.

SYSTEM DEVELOPMENT

5093. Abbas, B. M. UTILIZATION AND DEVELOPMENT OF THE DELTIAC AREA OF EAST PAKISTAN. U. N. Econ. Comm. Asia Far East. Water Resources Ser. 25: 133-151. 1963. 290.9 UN35F

A report was given on the utilization and development of the Deltiac area of East Pakistan.

5094. Agricultural Engineering Society (Japan). REPORT ON A CONCRETE PLAN FOR CULTIVATED CONDITIONS OF THE CENTRAL RECLAIMED LAND AT HAROSEKI DISTRICT. (Ja) Tokyo. 179 pp. 1963. 54 Ag8

5095. Akers, R. L. RECLAMATION OF WATERLOGGED AND MARSHY LANDS. Cong. Irrig. & Drain. Trans. 4(2): 11.33-11.48, maps. 1960. 55.9 C7652

A typical coastal drainage scheme was described for cash crops in the State of Johore in Malaya. The arrangement of the scheme and the factors affecting the design of the major components of the system were discussed.

5096. Antonov, V. I. RECLAMATION OF LANDS IN MESHCHERA LOWLAND. (Rus) Vest. Sel'skokhoz. Nauki 1960(12): 95-101, map. Dec. 1960. 20 V633
English summary.

A report was given on the draining and developing of lowlands in Meshchera.

5097. Arnold, F. D. THE WHEELER MACHINERY COMPANY LAND DEVELOPMENT PROJECT AND MULTIPURPOSE WATER MANAGEMENT PROGRAM. Utah Mosquito Abatement Assoc. Proc. 16: 30-31. 1963. 420 Utl

A report was given on a land development and water management program to develop techniques for multipurpose management of reusable water for the greatest mutual benefits to agriculture, fish and wildlife, public health, and related programs.

5098. Bac, S. IRRIGATION AND DRAINAGE IN THE PLAN FOR HYDROPROJECTS IN POLAND. (Pol) Nauka Polska 7(2): 206-213. Apr./June 1959. 475 N223

5099. Bakker, D., Jonker, J. J., and Smits, H. LAND RECLAMATION IN HOLLAND; BRINGING THE POLDERS INTO PRODUCTION. Span 3(4): 143-151, map. 1960. 464.8 Sp2

A symposium of four papers were given on land reclamation in the Netherlands.

5100. Bassan, E. THE DUTCH PLAN OF PROTECTION AGAINST THE SEA. (It) Riv. di Polit. Econ. 46: 516-518. June 1956. 280.8 R52

5101. Bazlen, K. A. THE PARTIAL RECLAMATION OF THE ZUIDER ZEE-BED SEEN FROM A CIVIL-TECHNICAL POINT OF VIEW. (Du) Netherlands. Dir. van de Tuinbouw. Meded. 19: 479-486. Aug./Sept. 1956. 86 N384
English summary.

A report was given on the partial reclamation of the Zuider Zee in the Netherlands. Two polders have been constructed and one is in the process. When the additional two polders are made all that will remain of the original Zuider Zee will be a fresh water basin called Ysselmeer.

5102. Boekel, P., and Bregman, L. POSSIBILITIES WITH THE WATER ECONOMY IN THE ZIJPE POLDER. (Du) Netherlands, Rlandbvoorlichtingsdienst. Landbvoorlichting. 16(6): 293-297. June 1959. 12 N383

5103. Bonezzi, L. RECLAMATION AND AGRICULTURE IN HOLLAND. (It) Bonifica Integrale 16(12): 412-417. Dec. 1962. 55.9 As72

5104. Bose, N. K. GANGA BARRAGE PROJECT. Sci. Club. J. 10: 39-42. June/Aug. 1956. 475 Sci29

A report was given of the Ganga Barrage Project in India for drainage and water supply for the area.

5105. Bosiger, K. NEW LAND ALL AROUND THE IJESSELMEER IN HOLLAND. (Ge) Leben u. Umwelt 13 (10/11): 127-225. July/Aug. 1957. 410 L49

5106. Bouwman, L. H. WIERINGERMEER DRY FOR 30 YEARS. (Du) Inzicht 14(7/8): 84-87. July/Aug. 1960. 44.8 In9

5107. Carsi, R. LOW COUNTRIES. (Sp) Cult. Mod. 46(6): 210-211. June 1963. 15 C89

5108. Chesterman, A. D. M. THE POLDERS OF HOLLAND. Chartered Land Agents' Soc. J. 58(2): 57-63. Feb. 1959. 282.9 L22

A report was given on the polders of Holland.

5109. Chesterman, A. D. M. RECLAMATION AND PLANNING IN HOLLAND. Chartered Surveyor 91(8): 428-431. Feb. 1959. 325.8 C38

A report was given of the drainage projects of Holland (Netherlands), including the Zuider Zee and older polders.

5110. Clews, J. HOLLAND'S NEW POLDERS. New Sci. 3(66): 16-18, map. Feb. 20, 1958. 472 N42

A report was given on farming Holland's new polders in the area that was once the Zuider Zee and additional areas in the process of reclamation.

5111. Dekker, P. J. J. POLDER CONCENTRATION IN ZEELAND. (Du) Econ.-Statis. Ber. 46(2316): 1183-1185. Dec. 13, 1961. 280.8 Ec722

5112. Djang, Y. H. RECLAMATION SCHEMES IN THE MEKONG DELTA IN VIET-NAM. U. N. Econ. Comm. Asia Far East. Water Resources Ser. 25: 220-224. 1963. 290.9 Un35F

A report was given on drainage and reclamation schemes in the Mekong Delta of Viet-Nam.

5113. Ebert, F. DRAINAGE OF SKJERNAEN. (Da) Hedeselsk. Tidsskr. 84(1): 3-27, maps. Jan. 15, 1963. 11 H35

5114. Edo, H. DREDGE-RECLAMATION OF LAND. Oriental Econ. 26(570): 204-206. Apr. 1958. 280.8 Or4

A report was given on dredge-reclamation of land in Japan.

5115. Edo, H. LAND RECLAMATION PROGRESS. Oriental Econ. 29(613): 653-656. Nov. 1961. 280.8 Or4

A report was given of land reclamation progress in Japan by use of dredges.

5116. Fedorov, B. V. DIVISION OF GOLOGNAIA STEPPE INTO NATURAL DISTRICTS AS A BASIS FOR DIFFERENTIATING THE MELIORATIVE [IRRIGATION AND DRAINAGE] AND CULTURAL COMPLEX. (Rus) Mezhrespub. Soveshcanie po Koordinatsii Nauch.-Issled. Rabot po Khlopkov. Mater. 1: 131-140. 1957. 72.9 M57

5117. Fenin, N. K. DANUBE CHANNEL-TISZA-DANUBE (YUGOSLAVIA). (Rus) Gidrotekh. i Melior. 10 (3): 42-48. Mar. 1958. 290.8 G362

5118. Ferguson, H. A. DELTA PROJECT: HYDRAULIC INVESTIGATION. Amer. Soc. Civil Engin. Trans. 125: 1290-1303. 1960. 290.9 Am3

A history was given of the delta project in the Netherlands. Conclusions were given on the effect of the delta project on the hydraulic regime of the area.

5119. Fischer, O. WATER CONDITIONS OF THE NORTH SEA COASTS OF SCHLESWIG-HOLSTEIN, PT. 3, THE MAINLAND, V. 5. (Ge) Berlin, Reimer. 328 pp. Ref. 1957. 331 F522

5120. Flamini, G. RECLAMATION IN THE PO DELTA. (It) Mercanzia 18(7): 585-589. July 1963. 287 B635

5121. France. Direction De La Documentation. AGRICULTURAL HYDRAULIC WORKS IN THE WESTERN MEDITERRANEAN. (Fr) France. Dir. de la Doc. Notes et Etudes Doc. 2779, 37 pp., maps. May 15, 1961. 280.9 F843

5122. French, R. A. DRAINAGE AND ECONOMIC DEVELOPMENT OF POLES'YE, U.S.S.R. Econ. Geog. 35(2): 172-180, maps. Apr. 1959. 278.8 Ec7

The drainage and economic development of Poles'ye, U.S.S.R., were discussed.

5123. Gerasimov, I. P., Zvonkov, V. V., and Buyanovskii, M. S. DANUBE PROBLEM AND MAIN QUESTIONS OF THE RECLAMATION OF THE DANUBE DELTA AND NEAR DANUBE LANDS ON THE USSR TERRITORY. (Rus) Akad. Nauk SSSR. Izv. Ser. Geog. 1961(5): 36-41. Sept./Oct. 331.9 Ak12

5124. Gil, L. THE ZUIDER ZEE: RECONQUERED LAND. (Fr) Agriculture [Paris] 23(222): 123-128, map. Apr. 1960. 14 Ag823

5125. Giudici, P. RECLAMATION WITH INTERMITTENT DOWNFLOW. (It) Acqua e il Suolo 10(6): 635-660. (Cont.) Nov./Dec. 1958. 55.8 Ac7

5126. Grechin, I. P., Afanas'ev, G. V., and Meshcheryakov, D. P. SOILS AND VEGETATION OF FLOOD-PLAIN MEADOWS OF THE NORTHERN DVINA RIVER AND PROSPECTS FOR UTILIZING THEM WITH REFERENCE TO THE PROJECT FOR REROUTING THE WATERS OF THE PECHORA AND VYCHEGDA RIVERS INTO THE CASPIAN SEA. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 71: 61-68. 1961. 20 M857

5127. Haasjes, K. H. S. LAND RECLAMATION, DEFENCE AGAINST THE SEA & WIND EROSION IN THE NETHERLANDS. J. Soil & Water Conserv. India 7(4/5): 16-24. July/Oct. 1959. 56.8 J824

A report was given of land reclamation projects in the Netherlands to control sea and wind erosion.

5128. Hanrath, J. J. DEVELOPMENT AREAS OF MEXICO. (Du) Tijdschr. v. Econ. en Sociale Geog. 47: 85-97. Apr. 1956. 280.8 T44
English summary.

A report was given on the underdevelopment of four farming areas in Mexico. The drainage works in two of the areas were discussed.

5129. Haret, C. THE DRAINING OF THE DANUBE PLAIN. (Rum) Prob. Agr. [Bucuresti] 10(12): 69-78, maps. Dec. 1958. 21 R862

5130. Herweijer, S. RECLAMATION IN THE LIGHT OF AGRICULTURAL DEVELOPMENT IN THE COUNTRY. (Du) Natl. Coop. Aan-en Verkoopver. v. de Landb. Cent. Bur. Meded. 45(1): 7-16, map. Jan. 1961. 12 N287

5131. Horth, B. LAND FROM THE SEA. Foreign Trade 112(3): 17-18, map. Aug. 1, 1959. 286.8 C162

A report was given on the reclamation of land in the Netherlands for the past, present, and future.

5132. Husemann, C. COMMUNITY WORK IN LAND CONSOLIDATION AREAS REQUIRING MELIORATION. (Ge) Deut. Landwirt.-Gesell. Mitt. 72(50): 1264-1265. Dec. 12, 1957. 18 N39

5133. Ibanez, C. M. DRAINAGE OF THE FIFTH CHILLAN PLAN. (Sp) Plan Chillan 4(11): 12-13. 1958. 281.8 B63

5134. Itie, C. G. POLDERS OF HOLLAND. (Sp) Chapingo 8(49): 19-22. (Cont.) Jan./Feb. 1955. 102 C36

5135. Japan. Ministry of Agriculture and Forestry. Agriculture Land Bur. FRESH WATER LAKE PROJECT OF THE BAY OF KOJIMA. Cong. Irrig. & Drainage Trans. 3(5): 10.189-10.204, map. 1957. 55.9 C7652

Irrigation and drainage works were discussed relating to a fresh water lake project in Japan.

5136. Kalkwijk, P. W. THE DELTA PLAN. Stikstof 8: 2-27, map. Aug. 1964. 57.9 St52Ae

A report was given of the delta plans used in the Netherlands.

5137. Kortooms, G. WATER MANAGEMENT IN LIEMPDE. (Du) Nederland. Heidemaatsch. Tijdschr. 72(7/8): 165-169. July/Aug. 1961. 12 N282

5138. Kristensen, K. J. SOME IMPRESSIONS FROM TRAVELING IN HOLLAND IN THE SPRING 1957. (Da) Hedeselsk. Tidsskr. 78(13): 283-288. Oct. 15, 1957. 11 H35

5139. Krustev, N. WATER IMPROVEMENT WORKS IN THE ALBANIAN PEOPLE'S REPUBLIC. (Bu) Koop. Zemedel. 1957(7): 38. July 1957. 280.28 K836

5140. Kuvshinov, I. RECLAMATION OF GROUND AND WATER RESOURCES OF THE VOLGA-AKHTUBA ZONE. (Rus) Ekon. Sel'sk. Khoz. 1961(3): 9-15. Mar. 1961. 281.8 So73

5141. Laurand, J. DIVISION OF ESTONIAN SSR ACCORDING TO DRAINAGE REGIONS. (Es) Estonskaya Sel'skokhoz. Akad. Sborn. Nauch. Trudov 25: 3-24, map. Ref. 1963. 106 Es83
German summary.

5142. Laurand, Y. K. DIVIDING ESTONIA INTO REGIONS FOR PURPOSES OF RECLAMATION. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiryazeva. Dok. 56: 91-99, maps. 1960. 20 M857

5143. Lingsma, J. S. HOLLAND AND THE DELTA PLAN. Rotterdam, Nijgh & Van Ditmar, 199 pp., map. 1963. 54 L64Ae
Translated from the Dutch.

A detailed report was given of the Delta plan in the Netherlands.

5144. MacGillavry, C. J. NEW LAND AT TIJGERKREEK. (Du) Landbouwnieuws 10(4): 7-9. July/Aug. 1958. 9.6 L234

5145. Mamaev, S. A., and Golovina, E. T. CERTAIN PROBLEMS IN THE UTILIZATION OF FLOOD LANDS ALONG KAMA RIVER IN THE UPSTREAM OF KUIBYSHEV RESERVOIR. (Rus) Moskov. Ordena Lenina Sel'skokhoz. Akad. im. K. A. Timiriazeva. Dok. TSKHA 26: 102-107. 1956. 20 M857

5146. Marcussen, N. RECLAMATION BEHIND THE DIKES. (Ge) Mitt. der Deut. Landwirt.-Gesell. 77 (23): 840, 842, 844. June 7, 1962. 18 N39

5147. Mesu, F. P. THE DELTA PLAN AND THE WATER ECONOMY OF GRONINGEN. (Du) Nederland. Heidemaatsch. Tijdschr. 73(6): 162-169. (Cont.) June 1962. 12 N282

5148. Muijen, J. C. WATER MANAGEMENT IN KENNEMERLAND. II. (Du) Groenten en Fruit 13(11): 299. Sept. 12, 1957. 80 G89

5149. Muijen, J. C. WATER MANAGEMENT IN KENNEMERLAND. IV. RUNOFF. (Du) Groenten en Fruit 13(13): 367. Sept. 26, 1957. 80 G89

5150. Muijen, J. C. WATER MANAGEMENT IN KENNEMERLAND. V. (Du) Groenten en Fruit 13(14): 398-399. Oct. 3, 1957. 80 G89

5151. Muller, F., and Fischer, O. WATER CONDITIONS IN THE NORTH SEA COAST OF SCHLESWIG-HOLSTEIN. THIRD PART: THE MAINLAND. (Ge) Vol. 6. Berlin, Reimer, 332 pp., maps. Ref. 1957. 331 F522

5152. Muotiala, S. DRAINAGE ACTIVITIES IN FINLAND IN THE 1950'S. (Sw) Nord. Jordbrforsk. Sup. 45(1): 41-49. 1963. 11 N752

5153. Nagaraja, V. N. THE SUNDARBANS OF WEST BENGAL. U. N. Econ. Comm. Asia Far East Water Resources Ser. 25: 182-186. 1963. 290.9 UN35F

A report was given on the present and recommendations for the future of a multipurpose reclamation project in West Bengal, India.

5154. Nakayama, S. STUDIES ON THE DEVELOPMENT OF AGRICULTURAL MANAGEMENT OF THE LAND RECLAIMED FROM THE SEA. I. THE RECLAMATION FROM THE SEA AND HISTORICAL DEVELOPMENT OF THE LAND. (Ja) Yamaguti U. Facul. Agr. B. 1956(7): 295-328. 1956. 107.6 Y14
English summary.

The history of agricultural management of an area in Japan reclaimed from the sea was given.

5155. Near East-South Asia Irrigation Practices Seminar. Helmand Valley Delegation. MARJA IRRIGATION, DRAINAGE AND SETTLEMENT PROJECT. Near East-S. Afr. Irrig. Pract. Seminar. [Proc.] 5: 269-284, map. 1964. 173.2 In8Reg

A detailed report was given of the Marja irrigation, drainage, and settlement project in Afghanistan.

5156. Netherlands Directie Van De Wieringermeer. Noordoostpolderwerken. ORIGIN AND DEVELOPMENT OF THE WIERINGERMEER POLDER; REVIEW OF THE RECLAMATION AND COLONIZATION OF THE FIRST ZUIDER ZEE POLDER. (Du) Wageningen, Veenman, 1955. 805 pp. Ref. 1955. 54 N384W
English summary.

A review was given of the reclamation and colonization of the first Zuider Zee polder in the Netherlands.

5157. Nielsen, P. K. DRAINAGE AND RECLAMATION BETWEEN SKJERN AND ULFBORG. (Da) Hedeselsk. Tidsskr. 82(15): 340-351. Dec. 10, 1961. 11 H35

5158. Offengenden, S. R. UTILIZATION OF RECLAMATION SYSTEMS. (Rus) Moskva, Gosudarstvennoe Izdatel'stvo Sel'skokhoziaistvennoi Literatury 1956. 535 pp.
(Uchebniki i uchebnye posobia dlia sel'skokhoziatstvennykh tekhnikumov) 54 Of2

5159. Perk, G. D. THE "VLEUTEN" RECLAMATION PROJECT NEARLY READY. (Du) Netherlands. Rlandbcons. v. Utrecht. Bedrijfsvoorlichting Jaarno. 1959: 17-19, map. 1959. 12 N3833J

5160. Pohl, E. DRAINAGE WORK OF THE RECLAMATION SOCIETY "PRETZSCHER BACH" IN THE AREA OF THE UPPER ELBE AND MULDE. (Ge) Wiss.-Tech. Fortschr. f. die Landwirt. 4(3): 109-110. Mar. 1963. 18 W763

5161. Poslavskii, V. V. UTILIZATION OF WATER RESOURCES IN JAPAN. (Rus) Gidrotekh. i Melior. 7(5): 41-58. May 1956. 290.8 G362

5162. Reed, R. H. THE DUTCH POLDERS: EIGHTH WONDER OF THE WORLD. Foreign Agr. 24(5): 4-5, 22. May 1960. 1.9 Ec7For

A report was given of the dutch polders.

5163. Rienks, A. CULTURAL TECHNICAL ASPECTS OF REGIONAL DEVELOPMENT. (Du) Landbk. Tijdschr., Dec. 1956(spec. no.): 1100-1113. Dec. 1956. 105.2 Or3

5164. Rossum, H. V. THE STRUGGLE AGAINST SURPLUS WATER AND WATER SHORTAGE. Way Ahead 8(3): 9-13. 1960. 280.8 W362

A report was given on the struggle against surplus water and water shortages in the Netherlands.

5165. Savitskii, L. M. CHECKING THE EXECUTION OF RECLAMATION PROJECTS, AND OF UTILIZATION OF RECLAIMED LAND. (Rus) Gidrotekh. i Melior. 8(8): 41-43. Aug. 1956. 290.8 G362

5166. Skodshoj, H. LAND RECLAMATION IN HOLLAND. (Da) Hedeselsk. Tidsskr. 79(5): 79-90. Apr. 15, 1958. 11 H35

5167. Smedegaard-Mortensen, J. THE EAST STORM WELDED TOGETHER. (Da) Hedeselsk. Tidsskr. 84(1): 27-32. Jan. 15, 1963. 11 H35

5168. Smits, H., and Venstra, A. J. RECLAMATION AND COLONIZATION OF THE NEW POLDERS IN THE FORMER ZUIDER ZEE IN THE NETHERLANDS. II. (Du) Tijdschr. v. Econ. en Sociale Geog. 50(3): 57-64. Mar. 1959. 280.8 T44
English summary.

A report was given on the reclamation and colonization of new polders of the former Zuider Zee of the Netherlands.

5169. Soet, F. De. DEVELOPMENT OF RECLAMATION IN THE NETHERLANDS. (Du) Landbk. Tijdschr. 73 (15): 663-687. Sept. 1961. 105.2 Or3

5170. Stahle, E. RESETTLEMENT OF 34,000 FARMS IN KARELIA: ROAD AND DRAINAGE WORK IN SETTLING 143,000 FAMILIES IN FINLAND AFTER 1945. Wasser u. Boden 13(2): 38-39. Feb. 1961. 56.8 W28

5171. Stelling, P. WATER DRAINAGE FROM DRENTHE VIA GRONINGEN. (Du) Nederland. Heidemaatsch. Tijdschr. 66: 313-317. Dec. 1955. 12 N282

5172. Sun, R. THE PRESENT DEVELOPMENT CONDITION OF THE CHO SHUI ALLUVIAL FAN, TAIWAN, CHINA. U. N. Econ. Comm. Asia Far East Water Resources Ser. 25: 160-181. 1963. 290.9 UN35F

A report was on the present and recommendations were for the future of a multipurpose program in Taiwan, China.

5173. Takes, C. A. P. PHYSICAL PLANNING IN CONNECTION WITH LAND RECLAMATION AND IMPROVEMENT. Internatl. Inst. Land Reclam. & Impr. P. 1, 79 pp., maps. 1958. 54.9 In8

A discussion was given of the physical planning of land reclamation and improvement projects in the Netherlands.

5174. Tomlinson, G. E. IN THE SOUTHEAST RIVER BASINS: LAND AND WATER RESOURCES DEVELOPMENT PLAN. J. Soil and Water Conserv. 18: 109-113. 1963. 56.8 J822

A plan for development of land and water resources in Southeastern United States was summarized in a proposed report prepared by the United States Study Commission, Southeast River Basins. The report details the Commissions's conclusions and recommendations after it took a 40-year look-into-the future at an 88,000 square mile area in Alabama, Georgia, Florida, South Carolina, and North Carolina.

5175. Tuinzing, W. D. J. RECLAMATION OF LAND IN THE DELTA AREA. (Du) Wageningen. Proefsta. v. de Akker- en weidebouw. Meded. 11, 7 pp. Feb. 1958. 64.9 W122

5176. Vadgaard, K. GREAT EXPECTATIONS. (Da) Hedeselsk. Tidsskr. 84(1): 37-39. Jan. 15, 1963. 11 H35

5177. Valken, K. F. THE WATER ECONOMY IN THE DELTA DISTRICT: SURFACE WATER DISTRIBUTION. (Du) Nederland. Heidemaatsch. Tijdschr. 70(2): 33-37, map. Feb. 1959. 12 N282

5178. Vicente-Orozco, J. SOMETHING ABOUT THE CIVIL ENGINEERING WORKS FOR WATER SUPPLY, DRAINAGE, IRRIGATION, AND FLOOD CONTROL IN CONNECTION WITH THE ECONOMIC DEVELOPMENT OF THE VALLEY OF MEXICO AND THE "MEZQUITAL" REGION OF THE STATE OF HIDALGO. (Sp) Ingen. Hidraul. en Mex. 16(L): 11-26, maps. Jan./Mar. 1962. 290.8 In43
English summary.

A report was given on the civil engineering requirements for a hydrology multiple project in Mexico.

5179. Volker, A. WATER MANAGEMENT OF THE NETHERLANDS. Way Ahead 8(3): 2-8, maps. 1960. 280.8 W362

A report was given on water management problems, research, and hydraulic engineering projects in a low-lying coastal area in the Netherlands.

5180. Volker, A. THE GREAT WORK FOR THE IMPROVEMENT OF THE DELTA REGIONS. (Fr) Internatl. Comn. Irrig. & Drain. Annu. B. 1963: 43-49. 1963. 55.9 In8A
English summary.

A report was given on the development of deltaic regions in the Netherlands.

5181. Vovchenko, I. T. HYDRAULIC ENGINEERING IN THE SEVEN-YEAR PLAN, 1959-1965. (Rus) Gidrotekh. i Melior. 11(2): 7-13. Feb. 1959. 290.8 G362

5182. Warne, W. E. GOLDEN STATE'S GOLDEN PLAN. Reclam. Era 47(4): 85-88, map. Nov. 1961. 156.84 R24

A report was given on the water development plan in California.

5183. Weissenborn, K. POLDERS AND DRAINAGE AS PRE-REQUISITES FOR THE FURTHER INTENSIFICATION OF FRUIT CULTURE IN THE LOWER ELBE. (Ge) Obstbauversring. des Alten Landes. Mitt. 18(2): 59-61. Feb. 1963. 85 J76

5184. Williams, D. A. DRAINAGE AS ONE PHASE OF WATERSHED DEVELOPMENT. Land Impr. 5(4): 24-25. Apr. 1958. 282.8 L224

The need to consider drainage as one phase of watershed development was discussed. In many cases, adequate treatment of the uplands and regulation of the upstream runoff reduces drainage needs. Upstream measures also protect drainage systems from flooding and silting.

Drainage is included in Watershed Projects, where it is needed and feasible, as part of an integrated multi-purpose program of flood prevention and water management.

5185. Zabegailov, A. DRAINAGE NETWORK IN THE CHUYA VALLEY. (Rus) Sel'sk. Khoz. Kirgizii 1961(8): 17-20. Aug. 1961. 20 Se493

5186. Zabegailov, A. A. EFFECTIVENESS OF THE ACTION OF A COLLECTOR-DRAIN NETWORK IN THE CHU VALLEY (WITHIN THE CONFINES OF THE ZONE OF JURISDICTION OF THE ZAPADNYI B. CH. K. II i III DISTANTSII). (Rus) Vsesoyuzn. Obshch. Pochvoved. Kirgizskii Filial. Izv. 1: 99-104. 1962. 56.9 V96

SEE ALSO--2, 6, 34, 37, 81, 97, 106, 110, 112, 140, 169, 178, 179, 180, 181, 200, 201, 212, 243, 329, 334, 349-351, 541, 542, 711, 724, 747, 772, 780, 798, 853, 879, 999, 1003, 1004, 1193, 1194, 1197, 1198, 1207, 1209, 1210, 1214, 1217, 1228, 1229, 1232, 1238, 1239, 1241, 1242, 1249b, 1258-1260, 1264, 1265, 1269, 1270, 1275, 1276, 1279, 1285-1288, 1290, 1294, 1297, 1300, 1301, 1303, 1305, 1317, 1319, 1320, 1324, 1330, 1336, 1339, 1342, 1348, 1350, 1351, 1356, 1360, 1364, 1365, 1367-1369, 1372, 1380, 1381, 1395, 1396, 1398, 1401, 1402, 1404, 1410, 1411, 1415, 1417, 1421, 1427, 1428, 1433, 1435, 1438, 1440, 1442, 1447, 1448, 1450-1452, 1459, 1465, 1468-1471, 1474, 1476, 1478, 1479, 1486, 1488-1491, 1494, 1496, 1585, 1602, 1604, 1606, 1612, 1645, 1647, 1649, 1672-1676, 1711, 1721, 1725, 1737, 1750, 1751, 1761, 1771, 1775, 1795, 1805, 1816, 1832, 1833, 1853, 1883, 1892, 1915, 1949, 1950, 1951, 1953, 1954, 1958, 1959, 1990, 1991, 2023, 2024, 2034, 2045, 2059, 2065, 2067, 2084, 2085, 2108, 2118, 2120, 2133, 2141, 2190, 2195, 2196, 2204, 2228, 2229, 2239, 2242, 2317, 2326, 2345, 2346, 2350, 2355, 2376, 2400, 2407, 2414, 2446, 2454, 2537, 2679, 2770, 2811, 2915, 2933, 2942, 3159, 3222, 3282, 3302, 3379, 3488, 3507, 3511, 3512, 3533, 3536, 3537, 3558, 3577, 3613, 3614, 3628, 3636, 3663, 3699, 3718, 3720, 3749, 3753, 3774, 3827, 3834, 3865, 3872, 3873, 3888, 3909, 3915, 3965, 3972, 3975, 3980, 3985, 3986, 4002, 4019, 4021, 4052, 4065, 4071, 4080, 4117, 4168, 4288, 4354, 4469, 4485, 4493, 4569, 4664, 4710, 4768, 4769, 4838, 4843, 4846, 4848, 4870, 4881, 4894, 4902, 4906, 4919, 4927, 4928, 4934, 4939, 4954, 4955, 4979, 5007, 5055, 5065, 5072.

INDEX

Author

(Number refers to item number)

Aamodt, H., 2606, 4087, 4088, 4089
Abagiu, P., 3000
Abbas, B. M., 5093
Abd-El-Samie, A. G., 365
Abduev, M., 3581
Abduev, M. R., 3582, 3583
Abduragimov, T. A., 1597, 1625, 3584
Abecasis, F. M., 2120
Abel, G. H., 2421
Abel, H., 156
Abell, L. F., 3585
Abichandani, C. T., 2422
Abraham, L., 4009
Abramowicz, M., 1
Abrarkhodzhaev, A., 4358
Abu-Zied, M., 3547
Abu-Zied, M. A., 1598
Acevedo-Ramos, G., 3586
Achtermann, A., 1599
Ackers, P., 1189
Adair, C. R., 3587
Adams, H. W., 1600
Adams, R. M., 64
Addison, H., 3588
Adrien, J., 157
Afanas'ev, G., 4822, 4823
Afansa'ev, G. V., 366, 5126
Afanas'ev, N. I., 766
Agaev, A. I., 158, 159
Agaev, B. M., 3589
Agafonova, A. F., 3590
Agarwal, R. R., 3591, 3592, 3999, 4077
Agarwala, S. C., 2423
Agasieva, S. I., 1190
Agerberg, L. S., 2424, 2425, 2426, 4824
Aglibut, A. P., 1900, 2427, 2773, 3593
Agnew, L. B., 1601, 2994
Agnew, R., 1602
Agreda, T. O., 1603
Agricultural Engineering Society (Japan)., 5094
Aguilo-Bonnin, J., 3037
Ahakeri, H. R., 163
Ahlf, H., 4469
Ahmad, N., 367, 1604, 2428, 3502, 3503, 3594
Ahmed, M., 4470
Ahmed, N., 4470
Ahuja, P. R., 3595
Ai, Y. H., 2995
Aidarov, I. P., 4471, 4502
Akademiia Nauk., 1191
Akers, R. L., 5095
Akesson, H. A., 1605
Akhmedov, A. A., 3596
Akhmedzhanov, M., 4090
Akhtyrtsev, B. P., 160
Akhundov, A. K., 3597
Akimtseva, Z. S., 2707
Akyurek, O., 1606
Alampi, P., 2429
Al-Ani, T. A., 692
Alban, K., 2430
Alban, L. A., 966
Alberts, R. R., 434
Albertson, M. L., 2202, 2243, 3559
Albescu, I., 3598, 3906, 3907
Albino-Figueroa, V., 3273
Albrecht, Z., 2431
Alcorn, F. B., 2996
Alderfer, R. B., 368
Alekand, K., 3274, 4472
Alekeevs'kii, E. F., 4825
Aleshchenko, V. Y., 1607
Alexandrescu, I., 2997
Alfnes, A., 1608, 4826
Alho, P., 4948
Aliev, I. G., 4473
Aliev, I. S., 4590
Aliev, Y., 4091
Aljibury, F. K., 3599
Allen, D. L., 5037
Allen, R. R., 2511
Allis, J. A., 1192
Allison, L. E., 369, 3600
Allison, R. V., 2432
Allison, U. S., 3601
Allred, E. R., 1657, 2008
Almazov, B., 1386
Almeida, A. A. F. De., 3602
Almlof, E., 4092
Alpan, I., 370
Alpat'iev, S. M., 161
Alpat'yev, A. M., 371
Alverson, K., 1193
Amanbekov, K. T., 2433
Amaya-Brondo, A., 162, 1609
Amemiya, M., 3603, 3604, 4093
Amer, A. V., 1500, 3605
Amer, F., 1610
American Society of Agricultural Engineers, Committee on Pump Drainage., 3504
American Society for Testing Materials., 372
Amerman, C. R., 548, 1292, 1356
Amson, F. W. Van., 1611, 2434
Anandakrishnan, M., 373
Ananyan, G. T., 3606
Anderson, A. G., 2273
Anderson, B. M., 238
Anderson, D. J., 1194
Anderson, D. M., 1612
Anderson, H. W., 1195, 1196
Anderson, I. E., 1237, 1524
Anderson, J. R., 2435, 4094
Anderson, M. A., 4827
Anderson, R. S., 1197
Anderson, W. E., 374
Andonov, T., 3244
Andreae, H., 1198
Andreev, O. B., 375
Andreev, S. V., 376
Andreevskii, N. S., 4095
Andrieux, C., 377
Andrijauskaite, E., 2435, 3275
Andrushchenko, G. A., 378
Angus, D. E., 887
Anicic, M., 2998
Anisimov, K. P., 1613
Anma, M., 379, 380
Anonymous., 1614, 3276, 4096, 4474, 4475, 5038
Antipov-Karataev, I. A., 3607
Antipov-Karataev, I. N., 381, 2437, 3608, 3609, 3610, 3611
Antipov-Karataev, J. N., 382
Antipow-Karatajew, I. N., 3612
Antonescu, I. P., 4476
Antonov, V. I., 3277, 3278, 3279, 3280, 5096
Antykov, A. Y., 3962
Aomine, S., 983
Apacible, A. R., 3613, 3614
Aparicio-Santos, J., 1615, 2999
Apmann, R. P., 4477
Apostol, I., 383
Aran', S., 3615
Arancibia, A. G., 300
Arany, S., 2438
Araujo, F. C. De., 3616
Archer, S., 1199
Archer, S. G., 4168
Arghiriade, C., 3000
Argyriadis, C., 1616, 1617
Arimura, S., 695, 696, 697, 4880
Aristov, S. G., 3617
Arkhipova, E. P., 2439
Armco Drainage & Metal Products, Inc., 4097
Armiger, W. H., 2864
Armstrong, J. J., 4098
Armstrong, W. W., 384
Arnold, F. D., 5097
Aronovici, V. S., 539, 540, 3281, 3324, 3618
Arsov, K., 1618
Artemov, N., 3129
Asghar, A. G., 385, 3505, 3619
Ashcroft, G., 1788A
Ashley, G. D., 2613
Askochenskii, A. M., 1619
Aslyng, H. C., 164, 386, 387, 2440, 3282
Asmussen, L. E., 524
Association Francaise Pour L'etude Des Irrigations Et Du Drainage., 1620

Astapov, S. V., 1200, 1501, 3602
Astapovich, B. V., 3621
Astrakhantsev, V. I, 1621
Atanasiu, G., 3860
Atkins, M. D., 3001, 3002
Atkinson, H. B., 3127
Attayodhin, C., 2445
Aubert, P. N., 3622
Audibert, M., 1743, 1744
Aull, J. L., 3157
Austin, R. H., 3463
Austin, W. G. L., 4478
Autio, K., 4099
Augustadt, W. W., 1622
Augustine, M. T., 3028
Australia Commonwealth Scientific & Industrial Research Organization., 388, 389
Avall, K., 1623
Aver'ianov, S. F., 1624, 4828, 4829
Aver'yanov, S. F., 1597, 1625, 1626, 2441, 3623, 4829
Avtonomov, A. A., 3624
Awada, M., 390
Axenova, I., 849
Axionova, I., 3906, 3907
Ayazi, M., 3625, 3778
Ayers, A. D., 807, 2791, 3626, 3627
Ayers, H. D., 391, 1502, 3367
Ayyar, L. V., 5025
Azarnia, E. A., 3628
Azevedo, A. L., 3629

Baak, B. C. P. H. Van., 165
Baathe, A., 166, 3283, 3284, 3285, 3286
Babb, A. F., 4648, 4649, 4719, 4720
Babcock, K. L., 392, 393, 2442
Babel, U., 2581
Babinski, S., 4949
Bac, S., 4950, 5098
Baden, W., 1201, 1627, 2443, 2444, 4830
Badenko, I. I., 3747
Baeker, U., 167
Bagirov, S. N., 1628, 3630
Bagramian, G. A., 4479
Baier, D. C., 1021
Bailey, R. W., 1202, 1203
Baissac, A., 1629
Baitkanov, K. A., 3631
Baker, G., 4125
Bakhulin, M. D., 168, 1630, 4831
Bakker, A. C., 3003, 3287, 3288
Bakker, D., 3488, 5099
Balakrishnan, M. R., 2445
Balba, A. M., 1631
Baldini, G. F., 2762
Ballantyne, A. K., 394
Balsotti, L., 3004
Balyabo, N. K., 3632, 3633
Bamesberger, J. G., 3634, 3635
Banfield, G. L., 4480, 4481
Banks, C. H., 395
Banting, A. E., 3289
Baquero, G., 3005
Baranowski, A., 2446
Barashev, V. F., 4832
Bardelli, U., 169
Barekyan, A. S., 1190
Barger, G. L., 980
Barker, M. G., 2447
Barker, R. F., 3636
Barkla, F. J., 3637
Barnes, C., 1204
Barnes, F. B., 1632
Barnes, K. K., 317, 1534
Barnes, O. K., 396, 1633
Barnett, A. P., 3112
Baron, V. A., 3638
Barona-De-La-O, I. F., 4482
Barreto, G. B., 1634
Barrett, J. W., 4100
Barrios, J., 1503
Barry, G. S., 3290
Barschdorf, M., 1635
Bartelli, L. J., 397, 874
Bartleet, J. R., 3006, 3007
Bartlett, R. J., 1636
Bartoszek, T., 2448
Bassan, E., 5100
Basse, N., 170
Batchelder, A. R., 2449, 2569, 2727, 2728, 2729, 2730, 2731, 2732
Batel, G., 1205
Bates, J. G., 4101
Batini, C., 2141
Battistelli, E., 171, 2450
Bauer, A. J., 2420
Bauer, W. J., 1637, 1638
Bausman, R. O., 28
Baver, L. D., 398
Bavngaard, A., 4951
Bay, R. R., 1206
Bazin, F., 2451
Bazlen, K. A., 5101
Beach, D. B., 1207
Beachell, H. M., 3587
Beadley, R. P., 3008
Beale, O. W., 869, 3112
Bear, J., 1208, 1581, 1639
Beard, L. R., 1209, 1210
Beare, J. A., 3009
Beasley, P. P., 1641
Beasley, R. P., 1067, 1529, 1640, 2060, 2061, 2122, 2123, 2255, 2256, 3010, 3011, 3012, 3013, 3014, 4102
Beauchamp, E., 399
Beauchamp, K. H., 3291, 3941, 4483
Beavers, A. H., 1143
Beck, V. S., 3015
Bedinger, M. S., 1413
Beer, C. E., 2452, 2453
Beer, E. E. De., 400
Beers, W. F. J. Van., 401
Befani, A. N., 1642
Begei, S. V., 2454
Begliarov, S. A., 3506
Behnke, J. J., 402
Beidler, E. J., 2388
Beirne, K. G., 3016
Beken, A. Van Der., 4103
Bekhbudov, A. K., 1643, 3639
Belikov, M. P., 403
Bellard, C. F., 3017
Bellis, R. E., 3018
Beloborodov, V. N., 3019
Bel'skaya, M. A., 2455
Benedict, R., 1644, 1880
Benini, G., 404
Benitez-Lopez, E., 3640, 3856
Bennett, A. C., 3233
Bennett, H. H., 172
Bennett, N. B., Jr., 2
Benson, M. A., 1211
Bentley, W., 4104
Benyaminovich, E., 4083
Benz, L., 2844
Benz, L. C., 405, 805, 960, 1212, 1213, 2843
Berdyanskii, V. N., 4105
Berdyev, O., 2456
Berg, E., 4106
Berg, F., 3641
Berg, K., 173, 1214
Berg, L. G., 406
Bergen, S. W., 43
Berggren, B., 3292
Berglund, G., 3, 1645, 3293, 3294, 4107, 4484
Bergman, I. I., 3295, 4827
Bernhardt, R., 4485
Bernstein, G., 4817
Bernstein, L., 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2543, 2563, 2564, 2612, 2792, 2981, 3642
Berry, I. L., 2061
Berry, J. L., 1215
Berry, W. L., 1646, 1647
Bersonova, K. A., 4609, 4610
Bertoni, J., 407, 1634, 1648, 3020
Bertrand., 867
Bertrand, A. R., 593, 1010
Besednov, N. A., 408, 3643 3644, 3645
Beshore, G., 3021
Beskin, L. I., 566
Beskov, I. K., 3296
Bessa, J., 4486
Bethlahmy, N., 409
Betremieux, R., 410
Betson, R. P., 1649
Bettenay, E., 411
Beutel, J. A., 412
Beutelspacher, H., 670
Bevilacqua, I., 174
Beville, B. C., 2258
Bhumbla, D. R., 2664
Bianchi, W. C., 413, 414, 415, 416, 643, 1075, 1650, 3646

Bidwell, O. W., 519
Bierhuizen, J. F., 417
Biggar, J. W., 418, 515, 516, 836, 837, 2573, 3647, 4074
Biggar, W. J., 3022
Bill, G. D., 458
Bina, D., 3648
Binsack, R., 1651, 2002
Birkaia, A. F., 4487
Birkman, Z. M., 419
Bishop, A. A., 1652, 1926, 3297
Bishop, A. W., 1504, 1505
Bitiukov, K. K., 420
Bitner, K., 421
Bittinger, M. W., 1216, 1217, 2318, 3515
Bjarnarson, B., 175
Bjerrum, L., 1506
Black, J. D. F., 422, 2471, 3298
Black, P. E., 1218
Blackburn, R. D., 2270, 2271, 4488, 4794
Blackburn, W. C., 4489
Blackmore, A. V., 411
Blackmore, L. C., 744
Blainey, J. M., 1653
Blair, G. Y., 4490
Blair, J. F., 3299
Blaisdell, F. W., 1507, 1654, 1655, 1656, 2068, 2069, 4108
Blake, D. N., 4109, 4110
Blake, G. R., 663, 1657, 1661
Blanco-De-Cordovat, I. S. D. C., 4491
Blaney, H. F., 1756, 3649, 4492
Blasco, F., 3627
Blazhis, B. I., 1658
Blesvik, K., 3300, 3301
Blewitt, R. I., 1659, 5026
Blidaru, A., 3507
Blidaru, E., 4111
Blidaru, V., 1219
Blintsov, I. K., 2472
Bliznyak, E. V., 1220
Bloemen, G. W., 176, 423, 2351, 3650, 4049
Bloodworth, M. E., 424, 2573, 2764
Bloom, W. M., 4112
Blosser, R. H., 2473, 2474, 2475
Blumel, F., 2476
Boa, W., 4113, 4114
Boawn, L. C., 2586
Bobchenko, V. I., 2477, 3651, 3652, 3653, 3654
Bock, R. O., 2413
Boddy, H., 1351, 1660, 3655
Bodhaine, G. L., 1221, 1222
Boekel, P., 5102
Boelter, D. H., 663, 425, 426, 1661
Boer, P. G. De., 3302
Bogdanov, P. L., 4952
Bogdanov, V., 4115
Bogdanovich, V. I., 3023
Bogliolo, A., 4493
Bogomolov, I. V., 3278
Bogomolov, S. P., 4116
Bogomolov, V. N., 4494
Bohmont, D. W., 1633
Bohr, R., 2629
Boiko, A. V., 2883
Bolelli, E., 3508
Bolotova, N. P., 4117
Bol'shakov, A. F., 3656
Bolt, G. H., 427, 428, 686
Bondurant, J. A., 429
Bonezzi, L., 5103
Bonfils, P., 430
Bonnet, J. A., 431, 2478, 3586
Bontempo, S. A., 4
Boodt, M. De., 432, 818, 819
Booher, L. J., 3728
Boomstra, G. J. W., 4495
Booy, A. H., 433, 4833
Bordar, M., 3700
Borden, J. W., 3024, 3025
Borenska, L., 2479
Borisenko, A., 177
Borland, W. M., 1373, 2304
Bornstein, J., 434, 1223, 1662, 1663, 3303
Borovinskaya, L. B., 435
Borovskii, V. M., 3657
Borowiec, S., 436
Borshchov, T. S., 3304, 4118
Borton, M. E., 5
Bos, H., 2385
Boschma, K., 178, 2480, 2481, 2482
Bose, N. K., 5104
Bosiger, K., 5105
Botha, A. D. P., 437
Bottini, O., 2483
Botzan, M., 3658
Boulle, P. F., 3305
Boumans, J. H., 1664, 1914, 3659
Bourne, M. S. A., 474
Boutcher, L. G., 4496
Bouwer, H., 438, 439, 440, 441, 442, 443, 444, 1224, 1508, 1509, 1510, 1511, 1512, 1513, 1514, 1515, 1665, 1666, 1667, 1668, 1669, 1670, 1671, 3306
Bouwman, L. H., 179, 180, 181, 1672, 1673, 1674, 1675, 1676, 5106
Bouyoucos, G. J., 445, 446, 447, 448, 449, 450, 451
Boving, P. A., 4119, 4120
Bovmans, J. G., 3660
Bower, C. A., 452, 453, 454, 455, 918, 1677, 2484, 2485, 2492, 2825, 3661, 3662, 3960
Bowers, S. A., 1869, 1870, 1871
Bowler, D. G., 1678, 1679, 1680, 1681, 1682, 3307, 3308, 3309, 3509, 4226, 4497, 4498
Bowman, D. H., 564
Bowser, W. E., 456
Boyaci, R., 3663
Boyce, S. G., 2631
Boyer, M. C., 1683
Boykin, F. M., 4499
Boyko, E., 2486
Boyko, H., 2486
Bozhanov, E., 4500
Braams, B. W., 1684
Bradfield, R., 2804
Bradford, G. R., 2487
Bradshaw, G. B., 1757, 3710
Braine, S. T., 1685
Braithwaite, D. L., 4501
Brakensiek, D. L., 1225, 1226, 1227, 1292, 1354
Braker, E. A., 4121
Brandyk, T., 2488
Branson, R. L., 457, 2805, 3664, 3758
Brasch, E., 4122
Brater, E. F., 1492, 2390, 2391
Brauer, B., 1686
Breazeale, E. L., 2489
Bregman, L., 5102
Breil, P., 3026
Breitenoder, M., 183, 1687
Brenes, E. J., 431, 3665
Bribiesca-Castrejon, J. L., 6
Brighten, C. W., 7
Brik, M., 4962
Brink, N., 1688
Brill, G. D., 3027
Briones, A. A., 459, 2490
British Columbia Department of Agriculture Field Crops Branch., 4834
British National Society., 1516
Broach, R. V. D., 3027, 3028
Broadfoot, W. M., 2491
Brockway, P. B., 5039
Bronitskii, N. I., 182, 1689, 1690
Bronnikova, L. V., 4835
Brooker, M. I. H., 3977
Brooks, D. R., 3310
Brooks, R. H., 460, 1517, 1518, 1691, 1692, 1693, 1822, 2492
Broslaw, J., 4123
Brouer, B., 4124
Brower, F. R., 5027
Brown, C. B., 1228, 1229
Brown, D. A., 461
Brown, E. M., 3666
Brown, J., 2493
Brown, M. V., 5040
Brown, P. L., 527, 584
Brownscombe, R. H., 3311
Bruce, R. R., 462, 463, 718
Brudastov, A. D., 184
Brudastova, R. A., 1694
Bruns, V. E., 4761
Bruns, V. F., 2494
Brupbacher, R. H., 868
Brusentsev, V. F., 4471, 4502
Brutsaert, W., 1695
Bryan, B., 4572
Bryan, B. B., 2665, 3667, 4125
Bucur, N., 464
Bud'ko, Y. N., 3668
Budyka, S. K., 1696, 4836, 4953, 4954, 4955
Buie, T. S., 1697, 3029

Bulavko, A. G., 2495
Bulgakov, N. P., 465
Bull, W. B., 1231
Bullard, R. G., 8
Bullock, A. E., 1232
Bululukov, Y. G., 2496
Bunch, C., 3197
Bunger, W. C., 810
Buniatian, L. B., 1698
Buras, N., 1699, 2158, 3669
Burcalow, F. V., 3030
Burema, J. J., 4126
Burford, J. B., 1233
Burger, K., 4503
Burgy, R. H., 466
Burke, H. D., 467
Burke, W., 1700, 2497, 4098
Burleson, C. A., 2573
Burn, K. N., 468
Burnett, G. I. S., 1701, 3031, 3032
Burns, B. E., 2498
Burns, G. R., 469
Burns, R. M., 2499, 2989
Burrows, W. C., 470
Burton, W. M., 4127
Burtseva, E. S., 1028
Burwell, R. E., 3127
Burwell, R. W., 5041
Burykin, A. M., 1519
Buscarlet, L., 377
Busch, C. D., 3312, 3313, 3314, 3315, 4128, 4129, 4130
Busch, K. F., 1702
Bush, K. K., 2500, 2501, 4956
Buss, K., 1703
Butijn, J., 1684
Butler, E. D., 1704
Butler, R. G., 859
Buttlar, H. von., 1234
Buyanovskii, M. S., 5123
Buzacott, J. H., 4131
Buzdin, A., 4132
Bylterud, A., 4504

Cabanius, M. M. J., 4505
Caestecker, K. De., 471
Cagauan, B. G., 459
Cahill, R. G., 3316
Cahoon, G. A., 1018, 1019
Cairns, R. R., 456, 2502
Caldart, F., 1235, 1705
Caldeira, F. M., 2503
Calembert, J., 2504
California Legislature. Joint Committee on Water Problems. 1706
Calissendorff, C., 1008
Calzecchi-Onesti, A., 9, 185, 186, 1707, 1708, 1709, 2505, 2506, 3033, 3034, 3035, 3036
Camargo, A. P. De., 472
Cambefort, H., 473
Cameron, J. F., 474
Camp, T. R., 1710
Campbell, A. P., 475
Campbell, R. B., 3670
Campbell, R. E., 2818, 3966
Canada, Department of Agriculture., 4133
Canada Experimental Farms., 4506
Candel-Fabregat, L., 3037
Cannell, G. H., 1520
Cano-Vicario, A., 1711
Caoili, A. A., 3593
Caponi, U., 1236
Capper, P. L., 1521
Carder, D. G., 5028
Carder, D. J., 4409, 4507
Carhart, A. H., 5042a
Carlier., 1522, 1523
Carlo, G. D., 3038
Carlos, A. D. P., 3671, 4508
Carlson, C. A., 476, 477
Carlson, C. W., 805, 1212, 2586, 2844
Carlson, R., 3662
Carlson, R. H., 4134
Carlson, R. M., 2442
Carlsson, H., 4135
Carlton, E. P., 3039
Carmichael, G. T., 5042b
Carmody, R., 3672, 4136
Caron, C., 473
Carpenter, A. J., 3762
Carreker, J. R., 3040
Carsi, R., 5107
Carter, D. L., 478, 2507, 2508, 2509, 2510, 2511, 3673, 3725, 3886
Carter, R., 3095
Carter, R. W., 1237, 1524
Carter, W. H., 4137
Carvalho-E-Vasconcellos, J. D., 2512
Cary, J. W., 1056, 1057
Casagrande, A., 1506
Cassidy, N. G., 2513
Cassie, W. F., 1521
Castagnetta, V., 4709
Castanon-Albertos, G., 4509
Castle, E. N., 121
Caterpillar Tractor Co., 3041
Catts, E. P., 5043
Caudwell, R., 3317
Cavazza, D., 479, 480
Cavelaars, J. C., 1712
Cavender, N., 3318
Cedergren, H. R., 1525
Ceisler, J., 4510
Cerkaski, M., 481
Ceskoslovenska Akademie Zemedelskych Ved., 187
Ceuca, G., 3000
Chabert, F. De., 1743, 1744
Chadwick, G. C., 5061
Chahal, R. S., 3674
Ch'ai, H., 482
Chalam, G. V., 163
Chambers, C. C., 1238
Chamblee, D. S., 2514, 2575
Chamski, R., 188
Chan, C. K., 1573
Chancey, H. W. R., 4140
Chang, C. L., 483
Chang, C. P., 1713
Chang, C. W., 484, 2515, 3675
Chang, T. T., 2516, 3042
Chang, T. Y., 482
Chang, Y. C., 2517
Chang, Y. T., 485
Chao, C., 668
Chapdelaine, P. W., 4703
Chapman, H. D., 884, 2669, 2805, 3676, 3677
Chapman, J. R., 4138
Chapman, V. J., 486
Chapovskaya, E. V., 487
Charlu, K. L. N., 2092
Charreau, C., 430
Chatfield, M. G., 488
Chatry, F. M., 1239
Chaudhri, I. I., 3678
Chaudhry, M. S., 2518
Chausson, J. S., 2822
Cheaney, R. L., 2519
Chekmarev, V. A., 1230
Chen, C. F., 655
Chen, H. S. C., 2063
Chen, L. I., 580
Chen, S. D., 489
Cherkasov, A. A., 1714
Chernen'kii, M. A., 3679
Chernenok, V. Y., 2404
Chertovskoi, V. G., 4957
Chesterman, A. D. M., 5108, 5109
Chia, S., 490
Chiba, S., 2681
Chichanov, K., 3043
Chiche, S., 1205
Childs, E. C., 491, 492, 1715, 1716, 1717, 1718, 1719, 1720
Chiles, R. E., 3197
Chin, S. J., 482, 490
Chippindale, H. G., 2520
Chirikin, N. I., 1721, 1722
Chirila, A., 2152
Chistotinov, L. V., 822
Chiusoli, G., 10
Chizhevskii, M. G., 3680
Choate, R. E., 3319
Cholakov, S., 11
Chow, V. T., 1240, 1723, 1724, 1725
Christensen, P. D., 3681
Christiansen, J. E., 3682
Christiansen-Weniger, F., 3044
Chu, Y., 1726
Chuang, H. C., 1727
Chun, R. Y. D., 1241
Chukreev, V. K., 3320
Chuprin, I. A., 493
Churikov, I. I., 3683
Churski, T., 854
Ciesla, W., 494

Claesson, S., 3045, 3046
Clark, F. E., 495
Clark, H. L., 496, 2521
Clark, J. S., 497
Clark, R. E., 12
Clarke, K. A., 1728
Clayton, J. S., 394
Clews, J., 5110
Cline, C. E., 1242
Closs, R. L., 498
Clutter, J. L., 652
Clyma, W., 3510
Cobos, L. P. De Los, 3684
Code, W. E., 3736
Cointepas, J. P., 2522
Cole, D. W., 499, 500
Coleman, N. L., 1243
Coleman, W. J., 13
Coles, L. E., 4511
Collett, G. C., 1729
Collis-George, N., 501, 1730
Colonial Sugar Refining Co., 189, 190
Colvin, J., Jr., 3685
Comes, R. D., 4547, 4761
Commonwealth Bureau of Soils, 1244, 1731, 2523, 2424, 2525, 3686, 3687, 3688, 4837
Commonwealth Bureau of Soils, 503
Commonwealth Bureau of Soils Bibliography on Estimation of Soil Moisture by Dielectric Logs, 502
Compiano, F. A., 5044
Compton, L. V., 4519
Conant, V., 5053
Concalves, P. A., 14
Condon, J. R., 4542
Conkling, F. E., 3511
Conlon, T. J., 3047
Connecticut Agricultural Experiment Station, 504
Conring, H., 1245
Consolo, F., 15
Constantinescu, G., 3048, 3049
Cook, P. M., 1526
Cook, R. L., 191
Cooke, F., 4139
Cooke, F. T., Jr., 4512
Cooley, J. H., 2526
Cooper, D. J., 1115, 4140
Cooper, W. C., 2527
Copeland, J. T., 1732
Copeland, O. L., 803, 1202, 1203
Copeland, O. L., Jr., 505
Coradini, M., 1733, 3050
Corbett, C. C., 3689
Corey, A. T., 506, 1517, 1518, 2207
Corey, G. L., 507, 1798
Corey, R. B., 500
Corley, T. E., 3051, 3052
Cornell, J. H., 16
Corry, J. A., 4513
Cosper, H. R., 795
Costa, A. O. L. Da., 472
Costel, G., 396
Cotner, M. L., 17
Coupland, R. T., 532
Court, A., 1246
Covey, W., 508
Cowley, E. W., 3604
Cowley, W. R., 2573
Cox, M. B., 3105
Coyle, J. J., 1527, 3002, 3053, 3054, 4404
Crabb, G. A., 1020
Craddock, G. W., 1247
Cramer, R. E., 4838
Crawford, C. L., 2778
Crescini, F., 3055, 3056, 3057
Criddle, W. D., 1248, 1528, 3690, 3734
Criquillion, Y., 4141
Crissey, W. F., 5078
Crockford, R. H., 4246
Croise, R., 4142
Cross, M. W., 4143, 4514
Cross, P. E., 4839
Cross, W. P., 1249a
Crowle, W. L., 2812
Cruz, S. R., 3691
Cullinane, R. E., 592
Culp, M. M., 1734
Culpin, C., 4144
Curry, R. B., 509, 1529
Curtis, W. R., 964
Cuthbertson, J. A., 4840
Cutler, W. A., 2678, 3492, 4515, 4516
Cutting, C. V., 510
Czekalski, A., 511
Czychowski, M., 18

Dabrowski, J., 192
Dadayev, G. T., 4517
Daelman, P., 193
Dagan, G., 1208, 1639, 1735, 1736
Dahiphale, M. V., 1249b
Daishev, T. I., 194, 195
Dalby, R., 4841
Dalrymple, R. S., 4146
Dancau, B., 3321
Danfors, E., 512, 513
Danfors, L. E., 514
Daniels, J. M., 755, 2956, 3234
Daniels, R. B., 4518
Danilevich, B. B., 2416
Danilov, I. Y., 4823
Dano, P. L., 2135, 2773
Dansercoer, W., 819
Darab, K., 3692, 3693, 3694, 3695
Dargie, G., 2528
Darlot, 4145
Darlot, A., 3696
Darpoux, R., 19
Darsie, R. F., 5043
Dastane, N. G., 3058
Datta, R. R., 1737
Davey, E. T., 4246
Davey, L., 196
David, H. T., 2452
Davidson, J. M., 515, 516, 517, 837, 1099
Davis, E. G., 197
Davis, G. H., 2529, 2803
Davis, I. F., 1250
Davis, J. F., 518, 2530, 4842
Davis, J. R., 717, 1738, 1790, 3568
Davis, M. S., 4146
Davis, R. D., 519
Davis, S., 3333, 3697, 3698, 5045, 5046, 5047, 5048
Davison, D. N., 5029
Davison, V. E., 4519
Davydov, A., 1251
Dawson, J. E., 520
Day, A. M., 5049
Day, P. R., 1739, 2049
De, P. K., 2531
Dean, E. H., 666
Dean, L. A., 469
Dean, T. M., 3059
Deb, A. K., 521
Debler, W. R., 1740
Decker, D. L., 534, 919
Decker, R. S., 1530, 4147
Deckers, J., 522
Deetjen, 198
Degan, A., 4148
Degtyarev, B. M., 1741
Deguchi, K., 3512
Dejou, J., 1742
Dekker, P. J. J., 5111
De La Rubia, J., 3627
De Leeuw, A., 3699
Dellenbach, P., 1743, 1744
Delleur, J. W., 2022
Delperee, R., 4149
Delver, P., 523
Dendy, F. E., 524, 1358
Denmark, Statens Forsogsvirksomhed I Plantekultur., 1745
De Padua, D., 1900
De Plater, C. V., 525
Dermott, W., 526
De Silva, C. A., 3060
Desmoulins, G., 4505
Despois, J., 3061
DeVries, L. L., 4383, 4384
Dewall, E. W., 199
Dewan, M. L., 3700
Dewey, D. R., 2532, 2533
DeWiest, R. J. M., 1531, 1746
De Zeeuw, J. W., 1747
Dhand, A. D., 2333
Dhar, D. M., 2169
Dhawan, C. L., 3701, 3702
Diamond, R. B., 1252
Diaz-Ambrona, D., 1748
Dickey, D. D., 527, 584
Dickinson, T. A., 4520
Dieleman, P. J., 1253, 1254, 3703
Dijk, D. C. Van., 1255
Dijkstra, R. J., 3322
Dill, H. W., 1389, 1749, 2435
Dillon, O. W., 5050
Dils, R. E., 1944
Dimitrova, E., 2091

Dincer, D., 3916
Dirksen, C., 528
Dirmeyer, R. D., 4150, 4521, 4522, 4523, 4524, 2525, 2526
Diseker, E. G., 3323, 4527
Diskin, M. H., 1256
Dixey, F., 1257, 3704
Dixon, R. M., 2644, 2645
Dizengof, G. I., 3062
Dizengof, L. F., 3062
Djang, Y. H., 5112
Dlayahu, E., 1330
Dluzewski, J., 1750
Dmitriev, I. D., 1751
Dmitrievskii, N. V., 4434
Dmochowski, A., 3705
Dobbs, P. J., 3706
Dobkins, B. B. E., 20
Dobrowolski, L. J., 200, 201, 3707
Dobranski, B., 529, 530, 531, 2577
Dodd, J. D., 532
Doddiah, D., 1752
Doering, E. J., 533, 534, 535
Dokoshi, J., 1535, 2400, 2534
Dolan, C. H., 4151
Dolgov, S. I., 3708
Domingo, C. E., 2827
Donahue, R. L., 163, 536, 537
Donat, J., 202
Doneen, L. D., 1766, 2535, 2536, 3709
Donnan, W. W., 203, 538, 539, 540, 1753, 1754, 1755, 1756, 1757, 1758, 2537, 3281, 3324, 3344, 3710
Donnelly, C. A., 4108
Donyushkin, V. I., 3063, 3135
Dooley, W. E., 541
Doorn, Z. Van., 542
Doornbos, J., 1759
Dootjes, E., 4528
Doran, W. E., 1258
Doubt, P. D., 1760
Douglas, R. J., 3047
Douglass, J. E., 543, 652
Doutre, J. L., 4529
Dow, A. I., 3755
Drablos, C. J. W., 21, 22
Dragoun, F. J., 1192
Drake, R. L., 2180
Dregne, H. E., 2538, 2875, 3662, 3675, 3711
Dreibelbis, F. R., 544, 545, 546, 547, 548, 549, 550, 636, 637, 638, 639, 640, 771, 1292
Drinker, P. A., 1923
Dronkers, J. J., 1761
Drost, H., 3007
Drouhin, G., 3712
Druml, F. V., 1557
Druvietis, R. I., 419
Druzhinin, I. G., 551
Dubakh, A. D., 4958
Ducharme, E. P., 2539
Dumay, L., 4530
Dumm, L. D., 1762, 1763
Duncan, A. A., 1764
Dunk, W. P., 4531
Dunkel, K. H., 552
Dunn, I. S., 1765
Dunn, L. E., 3713
Dupriez, G. L., 553
Durand, J. H., 1532
Dutt, G. R., 1766, 1767
Duyunov, I. K., 3724
Dybalski, J. N., 4532
Dylla, A. S., 554, 3325, 3326, 4699, 4700, 4701
Dzektser, E. S., 1768
Dzeventskii, G., 3714
Dzhafarov, K. F., 3715
Dzhulai, A. P., 3716
Dzhumaniiazov, K., 1769
Dzubay, M., 555

Eagleman, J. R., 556
Earle, S. L., 765
East, L. R., 23
Eaton, F. M., 1770
Eberhard, D. L., 807
Ebert, F., 1771, 5113
Eck, H. V., 557
Ede, A. N., 1772, 1773, 3327, 3328, 4152, 4153
Edelman, C. H., 558, 1259
Edelman, T., 4533
Eden, E. W., 1774
Eden, E. W., Jr., 1260, 1775
Edminster, T. W., 204, 317, 1534, 1776, 1777, 1778, 3064, 3065, 3066, 3067, 3068, 3069, 3313, 3314, 3315, 4130, 4154, 4155
Edo, H., 5114, 5115
Edwards, D. H., 1779
Edwards, F. E., 2540
Eelkema, L., 1402
Efendiev, N. T., 3329, 4156
Eftimie, A., 2152
Egberts, H., 3330
Eggelsmann, R., 1201, 1627
Egorov, L. I., 3708
Egorov, V. V., 559, 560, 728, 3717
Eguchi, K., 2687, 2688, 2689, 2691
Ehlig, C. F., 561, 600, 2541, 2542, 2543
Ehrler, W., 2544
Ehrman, K. S., 4534
Eichberger, W. G., 24, 2545
Einarsson, E. H., 4843
Einstein, H. A., 1780
Eisen, I., 2546
Eizen, I. A., 2547
Ekhlakov, S., 4242
Elema, H. M., 4535, 4536
Elepat'evskii, M. P., 4959
Eley, G. W., 3941
Elgabaly, M. M., 972, 1610
El Gibaly, H., 562, 1781
Elias-Castillo, F., 1782
El-Khatib, A. B., 3718
Elkins, C. B., Jr., 563
Ellerbe, C. M., 755
Ellingbo, M., 2548
Elliott, E. W., 1453
Elliott, I. L., 4844
Ellis, H. H., 5, 25, 26, 27, 28, 90, 136
Ellis, N. K., 2601
Ellsperman, L. M., 4537, 4538, 4539
El-Madani, M., 4157
Elmadany, M., 3331
Elmdahl, K. J., 205
Elpat'evskii, M. P., 2549
Elrick, D. E., 564
El Shabisi, A. I., 821
Elshabassy, A. I., 3719
Emel'ianov, V. A., 1200, 1261
Emel'yanov, V. A., 403, 565, 566
Endriga, B. G., 567
Engberg, C. A., 2530
Engel, R. E., 1783
Engelund, F., 1784
England, C. B., 568
Engler, K., 4572
Engulatov, I. A., 1262
Ennis, R. L., 1785
Enserink, G. A. R., 3720
Ente, P. J., 569
Epstein, E., 570
Erdman, L. W., 4540
Erdos, L., 571
Eremenko, G. V., 1262, 3513
Erickson, A. E., 1020
Erickson, H. T., 2601
Erie, L. J., 572
Eriksson, E., 573, 1263
Eriksson, R., 2550
Eriksson, S., 2551
Eringis, K. I., 2552
Erlandsson, I., 3332
Ernst, L. F., 1264, 1786
Escoffier, F. F., 1787
Estes, H. N., 1265
Etchevehere, P. H., 206
Etdujaili, A. M., 3721
Evans, D. D., 1058, 1788A
Evans, G. N., 501
Evans, N. A., 574, 707, 3333, 3722, 3723
Evaul, E. E., 3028
Evenson, D. E., 1564
Everett, R. K., 4383
Ewing, E. C., 3070
Eylands, A. G., 4845
Eyre, J. D., 4846
Ezafovich, A. S., 3724
Ezernack, F. J., 2553

Fabianowicz, M., 4847
Fafara, A., 4158
Faithful, W., 3334
Fanfan, R., 157
Fang, C. S., 575, 1788b

Fanning, C. D., 576, 2554, 2738, 3673, 3725
Farmer, E. J., 29
Farnham, R. S., 577
Fasken, G. B., 3071
Fassetta, L., 4002, 4541
Fatchikhina, O. E., 578
Faulkner, M. D., 3072
Fausey, N. R., 3345
Fedorov, B. V., 3726, 3727, 5116
Fedorowicz, W., 73
Fedotov, V. S., 3073, 3074, 3075, 3076, 3136
Feeney, J. L., 2043
Fefer, M., 4542
Feher, G., 4159
Fehr, R., 3077
Fehrenbacher, J. B., 579, 581, 1143
Feichtinger, F.,1789,3335,3336,4160
Feigin, M. P., 3337
Felicori, F., 2762
Feng, C. L., 580
Feng, K. S., 581
Feng, S. W., 30
Fenglerowa, W., 2708
Fenin, N. K., 5117
Fenzl, R. N., 1790
Feodoroff, A., 582, 3338, 3339, 3363
Ferda, J., 4283
Ferda, J., 1791
Ferguson, A. H., 583
Ferguson, F. L., 3340, 3341
Ferguson, G. E., 2355
Ferguson, H., 527, 584, 1792
Ferguson, H. A., 5118
Fernandez, M. B., 207
Ferrell, W. R., Jr., 1266
Ferrigno, F., 5051
Feuerstein, D. L., 1793
Fialkovskii, P. G., 208, 1794, 1795, 4848
Field, W. S., Jr., 1957
Filimonova, V. A., 3078
Filipowicz, J., 4849
Filippov, F., 4132, 4543
Filippov, I. G., 4161
Filonovich, P. K., 3378
Fine, L. O., 1796, 1797, 2930
Finfrock, D. C., 3728, 4544, 4545
Finkel, C., 3729
Finney, J. H., 761
Fireman, M., 454, 601, 918, 2468, 2555, 2556, 2557, 3642, 3664, 3730, 5052
Fischbach, P. E., 585
Fischer, O., 5119, 5151
Fishel, V. C., 1267
Fisher, C. P., 586
Fitzgerald, J. N., 4546
Fitzsimmons, D. W., 507, 1798
Flamini, G., 5120
Flannery, R. D., 587, 588, 3731
Flaxman, E. M., 1799, 1800
Fletcher, J. E., 589
Flint, S. E., 1048, 1801
Flodkvist, H., 31, 1802, 1803, 2558
Flor, C., 4162
Florent'ev, L. I., 216
Florschutz, O., 5043
Fly, C. L., 590
Foggo, A. S., 3732
Fojtik, S., 2559
Fokeev, P. I., 1804
Fokkenes, B., 1805
Foley, J., 1268
Fomenko, V. N., 4767
Fonseca, V. F. D., 1533, 2560
Fontenot, D. L., 3079
Foote, M. V., 5030
Ford, E. C., 1269
Ford, H. W., 2561, 3342, 3343, 3471
Foreman, H. G., 3080
Formin, A. S., 4960
Forsbacka, M., 4961
Forster, R., 1634
Fortsch, C., 4163
Fosberg, M. A., 691, 749, 895
Foster, A. B., 209
Foster, C. R., 4771
Fostikov, A. T., 3139
Fourie, J. P., 1806
Fouss, J. L., 1065, 2215, 2219,3344, 3345, 3346, 4164, 4165, 4166, 4167
Fowler, J. L., 3733
Fowler, L. C., 1270
Fox, D. R., 4648, 4649, 4719, 4720
Fox, R. L., 2562, 3734
Fox, W. E., 591, 592
Franca, L. D., 611
France Direction De La Documentation, 210, 5121
France Direction Generale du Genie Rural de Hydraulique Agricole, 3735
Francis, C. J., 1807, 4168
Francois, L. E., 2563, 2564, 2981
Frank, P. A., 4547
Franke, A., 2254
Franklin, W. T., 3736
Franklova, S., 848
Franzini, J. B., 1562, 2357
Fratric, I., 1808
Frazier, R. D., 593
Fredborg, A., 32
Frederick, W. J., 4075
Fredline, C. G., 5079
French, E. W., 3081, 3082
French, R. A., 5122
Fretay, M. E., 211
Frevert, R. K., 135, 317, 1534, 2343, 4384
Fritzsche, O., 4169
Frobe, A., 212
Frohlich, H., 2565
Frolkina, L. A., 3610
Frolov, N. N., 4548
Frosberg, M. A., 961
Fucer, W. H., 3737
Fujikawa, T., 3738
Fujimori, N., 1809, 2750, 4850, 4851, 4852
Fujimori, S., 1810
Fujimoto, M., 4549
Fujioka, Y., 594, 1811, 4550,4551
Fujisaki, M., 1271
Fujita, H., 2777
Fujita, N., 2313
Fukuda, H., 1812
Fulgham, F. E., 3083
Furuki, T., 1320, 1952
Fussell, G. E., 33, 4170

Gaastra, G., 213
Gadein, M. M., 4552
Gafencu, A., 464
Gailledreau, C., 2566
Gain, E. W., 3084, 3085
Galan, C. D., 34
Galben, T., 606
Galensa, F., 4553
Gallatin, M. H., 2449, 2567, 2568, 2569, 2725, 2726,2727, 2728, 2729, 2730, 2731,2732, 2953
Galloway, H. M., 3229
Gallwitz, K., 1813, 1814, 3347, 4171, 4172
Galvez, N. L., 910
Galvin, L., 1815
Gamble, M. D., 2570
Ganguli, K. D., 1816
Gankin, M. Z., 3506
Garboua, M., 1817
Garcia, F. G., 595
Garcia, S. G., 595
Garde, R. J., 1272
Gardner, J. L., 712
Gardner, W. H., 596, 811, 1792, 2173
Gardner, W. R., 561, 597, 598, 599, 600, 601, 602, 1818, 1819, 1820, 1821, 1822, 1823
Garev, E., 214, 603
Gariugin, G. A., 2571
Garkusha, I. F., 2572
Garland, K. R., 3514, 3637, 3739
Garner, M. M., 47
Garton, J. E., 4173
Gartvig, V., 3740
Gasser, J. K. R., 604
Gastila, L. I., 4174
Gatehouse, H. C. E., 1824
Gattis, J. L., 3741, 3742, 3743
Gavrilenko, G. A., 4359
Gavrilov, G. P., 3086, 3087
Gavrilov, I., 4962
Gee, H. C., 1825
Gelderman, W. J., 3585
George, E. J., 1213, 2843
Georgescu, I., 215
Georgiev, A. V., 216
Gerabek, K., 1273, 3744
Gerard, C. J., 2573
Gerasimov, I. P., 5123
Gereb, E., 1826
Gertenbach, J. J., 4175
Gertman, B. G., 217
Getov, L. V., 4853

Getty, H. C., 1274
Gheorghe, S., 605
Gheorghiu, E., 3754
Gheorghiu, I. M., 606
Ghildyal, B. P., 699
Ghosh, B. N., 2574
Ghowail, S. I., 2655
Ghumare, N. K., 3088
Gibaly, H. E., 3745
Gibbs, A. E., 1289, 1433
Gibson, A. N., 1827
Giefer, G. J., 1204
Giherd, P., 4554, 4555
Gil, L., 5124
Gilbert, W. B., 2514, 2575
Gile, L. H., 607, 608
Gillhoff, J., 3348
Gilly, G., 799
Gilman, H. H., 4176, 4177, 4178
Gilst, W. J., Van, 4179, 4180, 4181, 4268
Gimenez-Ortiz, R., 1782
Gingrich, J. R., 2576
Girbutchev, I., 609
Girshkan, S. A., 610
Giudici, P., 1828, 5125
Giuliani, E., 3089
Gizbili, M., 1606
Gjefsen, G., 1829, 4182
Glathaar, J. O., 3090
Glenn, J. H., 4556
Glerum, J. C., 4183
Glinski, J., 530, 531, 2577
Glopper, J. D., 569
Glover, R. E., 3515
Glukhov, I. G., 4557
Gobillot, T., 410
Gobin, C. A., 497
Godinache, J., 218
Goelen, E. H. G., 400
Goertzen, J. O., 2492
Gogalniceanu, S., 606
Goins, T., 1052, 1830, 1831, 2906
Gokan, M., 380
Gol'din, L., 4558
Golding, B. L., 1832, 1833
Goldstein, M., 4476
Golgofskaia, G. V., 843
Golikov, A. V., 4184
Golisch, K., 2696
Golovin, M. M., 4965
Golovina, E. T., 5145
Golovko, D., 3279
Gomes, M. P., 611
Gomez-Pompa, P., 3746
Goncalves, P. A., 35
Goncharow, V. N., 1834
Gondaira, S., 1535, 1835, 4854
Goodland, N., 36
Goodman, A. M., 2420
Goodrich, K., 4559
Goossens, K. J. C., 1836
Gorbachev, I. P., 4855
Gordin, I. M., 37
Gordon, J., 3349
Gorham, E., 612
Gorinskii, V. N., 3350, 4185, 4186, 4187, 4560, 4856, 4963
Gorlinski, J. S., 2578
Gorodetskii, L. N., 613
Gorskii, A. I., 2579
Goryunov, N. S., 3747
Goss, J. A., 2793
Gossuin, E., 1536, 1837
Gothe, H., 4188
Goto, S., 3516
Gottlich, K., 2580, 2581
Gougler, D., 4561
Gould, M. L., 197
Goulding, P. F., 4189
Gowans, K. D., 2499
Graage, W., 4562
Grabarczyk, S., 123
Grabovskaia, O., 3748
Gradwell, M. W., 614
Graeber, W., 219
Graeve, G. De, 3480
Graf, W. H., 1780
Graham, B. F., 2582
Graham, E. H., 220
Graham, L. O., 38
Graham, S. A., 2848
Gram, A. L., 2043
Grande, C. R., 3749
Grant, A. J., 4190
Grant, C. L., 2493
Grant, L. O., 1426
Grant, W., 4572
Grant, W. J., 570
Grant, Z. C., 1275
Grasby, J. C., 1838, 4410
Gratzl, D., 3750, 3751
Graveland, D. M., 3752
Gray, D. A., 676
Gray, D. M., 1276, 1905
Gray, H. E., 444
Gray, R. W., 4563
Grazys, J., 3091
Great Britain Ministry of Agriculture Fisheries & Food, 221, 3351
Grebennikov, V. N., 2583, 3517
Grebing, G., 2584, 3352
Grechin, I. P., 2585, 5126
Green, K. D., 1839, 4564
Green, R. E., 1840
Green, R. L., 2955, 2956, 3092
Green, V. E., Jr., 4857
Greenland, D. J., 615
Greig, D. J., 3093
Grereb, E., 1841
Gres, G., 4565
Grigor'ev, V. D., 1842, 4566, 4567
Grigsby, B. H., 4515
Grimes, J. W., 39
Grimes, M., 1277
Grimm, C., 4623
Grimm, K., 4191, 4192
Grimsson, K., 222
Grizzell, R. A., Jr., 4568
Grodau, G., 4193
Grogger, H. E., 732
Gromicho, A. P., 4508
Groot, H. D., 4569
Gross, C., 3753
Grover, B. L., 1843, 1844, 1845, 1846
Groves, E. R., 4194
Gruner, W., 4570
Grunes, D. L., 2586
Grunig, P. E., 2587
Gruzdev, D. M., 2588
Gruzis, A. I., 2589
Gubar', N. S., 223, 224
Gubarev, A. N., 616
Gudalin, V. I., 4195
Gudzhabidze, N. I., 4487
Guenzi, W. D., 2646
Guillot, R., 4196
Guitton, J., 377
Guleichik, K., 4878
Guleichik, N. A., 4879
Gunthart, A., 225
Gupta, C. P., 3592
Gupta, R. P., 617
Gupta, S. O. P., 1847
Gupta, Y. C., 1848
Gurr, C. G., 618, 619, 620
Gurtsev, I. P., 4964
Gurvich, I. I., 4197, 4965
Gusev, D. M., 4412
Gusev, S., 4198
Guspan, J., 2590
Gustafsson, Y., 1803, 4966
Gustiuc, L., 3754
Gutierrez-Cortes, H., 1849
Guyon, G., 1850, 1851, 1852
Guz, T., 530
Guzman, L. E., 40, 3094
Gyurov, G., 621

Haabeth, M., 4858
Haahr, V., 622
Haaijer, B. M., 1937, 1938
Haans, J. C. F. M., 623
Haas, R. H., 2591
Haase, H., 226, 4571
Haasjes, K. H. S., 5127
Haddock, J. L., 1059
Hafenrichter, A. L., 3868
Hagan, R. M., 925, 2940
Hagerup, H., 4859
Hagood, M. A., 3755
Hague Instituut Van Ingenieurs, 1853
Hahn, R. H., 1854
Hain, A., 1855
Haise, H. R., 624, 625, 3662, 3690
Hakansson, A., 41, 227, 626, 1856, 1857, 1858, 1859, 2592, 3353, 4199
Halchias, N. A., 1860
Haldre, H., 3518
Halevy, E., 627, 628
Hall, C. W., 303
Hall, G., 4900
Hall, H., 2050

Hall, T. F., 2593
Hall, V. L., 2594, 4572
Hall, W. A., 1278, 1279, 1280,1861
Hallam, M. J., 4368
Hallgren, G., 1862, 2595, 2962, 3354, 3355, 3756, 4200
Hallmen, B., 4573
Halsey, D. D., 3757, 3758
Hamalainen, M. S., 4201
Hamid, A., 385
Hamid, C. A., 4574
Hammad, H. Y., 1537, 1538, 1863, 1864, 1865, 1866, 1867
Hammond, L. C., 1014, 1252
Hand, J., 3095
Handa, B. K., 1868, 2596
Hanks, B. C., 3096
Hanks, R. J., 629, 1840, 1869, 1870, 1871, 2223, 2224
Hannah, H. W., 42
Hannigan, M. A., 1872, 3356
Hanrath, J. J., 5128
Hansen, C. J., 2597
Hansen, R. L., 3357
Hansen, V. E., 630, 3779
Hanson, E. G., 4575, 4576
Hantush, M. S., 1281, 1282, 1283, 1873, 1874, 1875, 1876, 1877, 3519, 3520, 3521, 3522, 3523, 3524, 3525, 3526, 3527, 3528, 3529, 3530
Haq, S. D., 1284
Haq, Z. U., 1604
Haque, M. A., 2607
Harada, I., 674
Harber, D., 43
Harder, J. A., 1285, 1286
Hardesty, J. S., 570
Hardin, J. R., 1287
Harding, R. B., 2499, 2598, 2599, 2600
Harding, S. T., 44, 1288
Hardman, R. L., 631
Hardy, M., 632
Haret, C., 1878, 3658, 5129
Harildstad, E., 288, 4202, 4203, 4204, 4205
Harkness, K. A., 629
Harleman, D. R. F., 1422
Harpaz, Y., 628
Harries, G. O., 4311
Harris, B., 1289, 1433
Harris, C. I., 2601
Harris, K. A., 3358
Harris, S. A., 633
Harris, W., 1644
Harris, W. F., 634
Harris, W. S., 1879, 1880, 2602, 3097, 3098, 3099, 3100, 3101, 3102, 3103
Harrison, D. S., 1881, 1882, 2603, 2765, 3531, 3759, 3760, 4206
Harrison, R. W., 229, 3761
Harrold, L. L., 635, 636, 637, 638, 639, 640, 771, 1290, 1291, 1292, 1293, 1355, 1356
Hart, F. C., 4577
Hart, M. G. R., 3762
Hartman, M. A., 1294
Hartmark, H., 2604
Harvey, N., 45, 46, 3359
Hasebe, J., 641
Hashizume, A., 2609
Haskell, C. C., 642
Haskell, E. E., 3646
Haskell, E. E., Jr., 414, 415, 643
Haskew, H. C., 769, 3478
Hassan, M. N., 972
Hassan, N. A., 2357
Hassed, R. D., 4207
Hastie, E. L., 3132
Hatch, W. B., 3864
Hatch, W. R., 4860
Hatcher, J. T., 455
Hatt, J., 2605, 4208
Hattori, T., 4551
Haugen, O., 2606, 4209
Hausenbuiller, R. L., 2607, 3763,3764
Hauser, V. L., 644, 1100, 3104, 3105, 3106, 3107, 3108, 3270, 3271, 3360
Haushild, W., 1295
Haushild, W. L., 2245
Haushofer, H., 645
Haveraaen, O., 4967
Hawkins, J. C., 2608
Hawkins, R. H., 642
Haws, F. W., 4210, 4644, 4645
Hay, R. C., 3102, 3127
Hayashi, M., 230, 2609
Hayashi, N., 1320
Hayes, M. H. B., 646, 647, 2610
Haynes, F. L., 2698
Haynes, H. D., 4211, 4212, 4213
Hays, O. E., 3109, 3110, 3111
Haythornthwaite, R. M., 1539
Hayward, H. E., 2469, 2556, 2557, 2611, 2612, 2793, 3967
Hazan, R., 1883
Hazlewood, B. P., 3220
Heafield, T. G., 2613
Heagy, K., 1296
Heard, W. L., 1297
Hebb, E. A., 2614
Hedges, R. F., 47
Heeney, H. B., 4875
Heese, K., 3361, 3366, 4214, 4215, 4216
Heikurainen, L., 1884, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 4861, 4862, 4968, 4969, 4970
Heilman, M. D., 2623, 3156
Heimann, H., 2624
Heinemann, H. G., 1298, 1299
Heino, E., 4217
Heinselman, M. L., 649
Hellberg, A., 2625
Hellinga, F., 48, 231, 1300, 1301, 1747, 2415, 3765
Helm, R. W., 5053
Helms, J. O., 3052
Henderson, C., 5071
Henderson, D. W., 2536, 3766
Henderson, F. M., 1302, 1885, 1886
Henderson, J. M., 1887, 1888
Henderson, R. C., 2260, 3233
Henderson, W. D., 5053
Hendricks, S. B., 650
Hendrickson, B. H., 3112
Henin, S., 3362, 3363
Henkel, D. J., 1504, 1505
Henman, D. W., 4971
Henning, H., 49
Henze, J., 4578
Heppner, M. B., 4218
Herfeld, T., 1889, 1890
Herke, S., 3767
Herlong, B. E., 50
Hermansen, N. K., 51
Hermsmeier, L. F., 1891, 3113, 4280
Hernandez-Agosto, M. A., 3532
Herndon, L. W., 1892
Herpich, R. L., 4219
Herweijer, S., 5130
Hesse, W., 648
Heuvein, B. van, 651
Hewlett, J. D., 652, 1893
Heyndrickx, G. A., 1894
Hibbert, A. R., 1893
Hickey, M. E., 4539
Hickey, T. J., 3438
Hickok, R. B., 1303
Higginson, R. K., 52
Hilchey, J. D., 4579
Hilde, D. J., 2626
Hill, D. E., 653
Hill, P. R., 3114
Hill, R. A., 1895
Hill, R. G., 3115
Hillel, D. I., 1823
Hills, R. S., 1896
Hillsman, G., 1078
Hiltibran, R. C., 4580
Himbeeck, C. Van., 3533
Hinesly, T. D., 1897
Hingston, F. J., 411
Hino, M., 1898
Hintikka, V., 3364, 3365
Hirahara, H., 2313
Hitake, Y., 654
Hjalmarsson, B., 2627, 4092, 4220
Ho, C., 655
Hoare, E. R., 3768
Hobba, R. L., 1196
Hobbs, E. H., 2628
Hobbs, H. W., 1304
Hobbs, J. A., 656
Hodgkin, B. M., 1899
Hodgson, J. M., 4761
Hodgson, R. H., 4547
Hoelscher, L., 53
Hoff, P. R., 1900
Hoffman, G. J., 1901
Hoglund, O. K., 3868
Hohendorf, E., 2629
Hohn, C. M., 998
Holjewilken, H., 3361, 3366, 4221, 4365
Holland, J. P., 2703

Holland, W. D., 2963
Hollander, R. D., 4863
Holmberg, G., 3116
Holmen, H., 4581
Holmes, J. W., 657, 658, 659, 660, 661
Holmes, R. G., 4167
Holmes, R. M., 662
Holowaychuk, N., 967, 1052
Holstener-Jorgensen, H., 4972
Holt, R. F., 663
Holtan, H. N., 664, 1305, 1306
Holtz, W. G., 4582
Holz, W., 4583, 4584, 4585
Hommik, K., 1902
Honan Sheng Shang Ch'iu Chuan Ch'u K'o Hsueh Chi Shu Hsieh Hui, 3769
Honeyfield, H. R., 4222
Honjo, Y., 695, 697, 4880
Hood, W. D., 4499
Hoogers, B. J., 4586
Hoorn, J. W. Van, 1307, 1903, 2939
Hoover, C. A., 585
Hoover, M. W., 2698
Hopewell, H. G., 1904
Hopkins, R. C., 5054
Horansky, J., 4223
Hore, F. R., 665, 1905, 1906, 3122, 3367, 4459
Horiguchi, H., 4864
Horlings, A., 5055, 5056
Horn, D. L., 1308
Horn, M. E., 666
Horth, B., 5131
Horth, C. J., 1907
Hosner, J. F., 2630, 2631
Hosoyamada, K., 1540, 1908, 1909, 1910, 1911, 3368, 4587
Hough, B. K., 1541
Houston, C., 3399
Houston, C. E., 1912, 1913, 2088, 3369, 3770, 3771
Hovd, A., 4865, 4866, 4867
Hovde, O., 4868, 4869
Hove, P., 4224, 4225
Howe, O. W., 3117
Howell, D. T., 1280
Hoy, R. E., 4499
Hoyt, W. F., 1341
Hrcek, L., 3118
Hsavrygin, P. I., 997
Hseung, Y., 3772
Hsi, C. F., 667, 668
Hsi, C. L., 752, 3773
Hsia-Tien, H., 4870
Hsin, T. C., 3831
Hsu, C., 232, 2632
Hsu, C. F., 3774
Hsu, E. Y., 1563
Hsueh, K. Y., 1542
Huang, H. C., 2995
Huang, S. P., 1309
Hubbard, L. R., 4588
Hubbell, D. W., 1310
Huberty, M. R., 2284, 3649
Hudig, J., 669, 670
Hudson, A. W., 4226
Hudson, J. C., 671
Hue-Herrero, F., 4589
Huet, J., 672
Huffaker, A., 2633
Hugenberg, G., 4749
Hughes, H. F., 3082
Huikari, O., 2634, 2635, 2636, 4227, 4871, 4973, 4974
Huisman, H., 4711, 4712
Hull, D. O., 3217
Hulsbos, W. C., 233, 1914, 3659
Hummon, G. A., 3370
Humpherys, A. S., 4645
Hunt, D. M., 3371, 3372
Hunt, H. F., 1915
Husbands, R. C., 5066
Husemann, C., 5132
Hussein, M. A., 3719
Huston, W. E., 4602
Hutchins, W. A., 54, 55, 56, 57, 58, 59, 60
Hwang, S. Y., 2037, 2038

Iancu, M., 3119
Iandolo, E., 62
Iakovlev, B. I., 61, 234, 235, 1916
Iarovenko, V. V., 4590
Ibanez, C. M., 5133
Ibragimov, S., 1917, 3775
Ice, P. W., 5032
Ichikawa, Y., 4591
Ichinohe, S., 3120
Igaki, C., 3516
Igarashi, G., 230, 2609
Ignatenok, F. V., 236, 1918, 1919, 3373, 3374, 3776, 4228, 4229
Ignat'eva, V. M., 4828, 4829
Ignatiuk, G. L., 4592
Ignatyuk, C. L., 1311
Iijima, H., 1424
Iizuka, J., 673
Ikeda, M., 674
Ikehasu, S., 1173
Ikemi, T., 4323, 4324
Il'kun, G. M., 675
Imanishi, T., 1049
India Committee on Natural Resources, 3777
Indiana Flood Control and Water Resources Commission, 1312
Indyk, H. W., 4593
Ineson, J., 676
Inileev, A., 4035
Instituut Voor Landbouwtechniek En Rationalisatie. Afdeling Mechanisatie Cultuurtechniek, 4230
Ionat, V. A., 1920
Ionescu, I., 4476
Ionescu, V., 3121
Iovenko, N. G., 1921
Iowa Agricultural Experiment Station, 1922
Ippen, A. T., 1923, 1942
Irrigation & Drainage Division Research Committee, 237
Irwin, R. W., 63, 1906, 3122, 3341, 3367, 3375, 3376, 3377, 3534, 4594, 4595, 4596
Isaev, D. I., 551
Isherwood, J. D., 1924, 1925
Ishida, Y., 3516
Ishigenov, I. A., 3680
Ishikawa, T., 1163, 1164, 3458, 3459
Ishisaki, T., 701
Ishizuka, Y., 2637, 2638, 2639, 2640, 4872
Isidoro, G., 4231
Isozaki, H., 677
Israelsen, O. W., 238, 1926, 3778, 3779
Itie, C. G., 5134
Ito, E., 2689, 2690, 2691, 3809
Iunevich, D. P., 239, 4232, 4828, 4873
Iurin, I. A., 3610
Ivanicka, J., 2641
Ivanov, K. E., 5011
Ivanov, S. A., 4233, 4358
Ivanov, S. Y., 1478
Ivanova, E. N., 678
Ivitskii, A. I., 1927, 1928, 1929, 1930, 1931, 1932, 3378
Iwasa, Y., 694, 794, 1933
Iwata, S., 1162, 1934
Iyer, T. A. G., 2642
Izergin, A. I., 2643
Izu, T., 1313
Izvekov, A. A., 2774

Jaakkola, O., 3379, 4234
Jacks, J. F., 3103
Jackson, R. D., 679, 680, 681
Jacob, C. E., 3527, 3528, 3529
Jacobs, H. S., 2644, 2645
Jacobsen, T., 64
Jacobson, P., 65, 303, 1935, 3123, 3124, 3217, 4603
Jager, A. W. De, 240, 1314, 1936, 1937, 1938, 3380, 3381, 3382, 4235, 4236, 4237
Jaguszewski, T., 241, 242
Jain, J. K., 3780
Jamison, V. C., 682, 683, 684 685, 732, 4597, 4598
Janert, H., 3781, 4238
Janitzky, P., 1136
Janse, A. R. P., 686
Janzen, D. H., 5057
Japan Agr. Land Bureau, 66
Japan Ministry of Agriculture and Forestry Agriculture Land Bureau, 5135
Jarocki, W., 1939
Jarrett, G., 4874
Jarvela, H. A., 687
Jarvis, M. W., 3383
Jasmin, J. J., 4875
Jasnowski, M., 688
Jaworski, J., 243
Jeffery, J. W. O., 3762
Jeffries, C. D., 2647

Jelinek, J., 3782
Jen, Y. M., 1940
Jenkins, E. D., 1315
Jenkinson, A. F., 660
Jennings, A. R., 1316
Jensen, C. R., 876
Jensen, M. E., 405
Jensen, S. T., 4876
Jerven, O., 4239, 4599
Jesenak, J., 1941
Jo, K., 2985, 2986
Jobbins, D. M., 5073
Jobe, R. N., 4600
Jobin, W. R., 1942
Jodo, S., 1049
Joglekar, D. V., 1943
Johannes, H., 4585
Johannes, R., 3125
Johannes, R. F., 3030
Johnson, A. G., 244
Johnson, D. D., 2646
Johnson, E. A., 1944
Johnson, E. G., 4601
Johnson, G. I., 4602
Johnson, H., 5058
Johnson, H. P., 1945, 2030, 2031, 2032, 2216, 2854, 4344, 4603
Johnson, J. A., 67
Johnson, L., 2355
Johnson, L. E., 1317
Johnson, L. G., 1318
Johnson, L. J., 2647
Johnson, S. M., 1377
Johnson, W. O., 2648
Johnston, W. R., 689, 690, 3384, 3646
Joint Committee on Water Problems California Legislature, 68
Jones, B. A., 22, 1946, 1947, 3127, 3194, 3385, 3464
Jones, B. A., Jr., 1948, 3126
Jones, C. W., 4604, 4605
Jones, D. S., 69, 70
Jones, G. O., 3514, 3637, 3739, 3783
Jones, G. W., 3216
Jones, H. I., 1319
Jones, L. A., 150
Jones, M. J., 4606
Jones, P. D., 2649
Jones, R. L., 498
Jones, R. M., 4607
Jones, W. W., 2599
Jong, A. De, 245
Jongerius, A., 651, 2650
Jonker, J. J., 5099
Jonkers, G. A., 4240
Jonsson, A. L., 246, 4877
Jonsson, I. G., 2045
Joshi, K. V., 3784
Joshi, M. S., 3058
Jordan, J. V., 691, 749
Jumikis, A. R., 1543, 1544
Jurimae, A., 2651, 2652
Juusela, T., 71, 247, 248, 2653, 3386, 3387, 3388, 4241
Juva, K., 249
Juve, R. L., 2521

Kachuko, I., 4878
Kachuro, I. M., 4879
Kaddah, M. T., 2654, 2655
Kader, G. M., 2437, 3610
Kadir, A., 1949
Kadlec, J. A., 5059
Kadman, A., 2656
Kadrevich, T. A., 3535
Kadri, L., 4064
Kadry, L. T., 523
Kadyrov, R. S., 3785, 3786
Kagan, D., 4242
Kagawa, K., 3174
Kagawa, S. I., 3174
Kahlon, S. S., 3702
Kaiser, G., 72
Kaitera, P., 2657, 2658
Kalantaev, V., 3787
Kalbfleisch, W., 4297
Kalechits, N. P., 2841
Kalisvaart, C., 1950, 1951, 3536
Kalkwijk, P. W., 5136
Kalmykov, S. S., 3128
Kalnins, A., 2659
Kalnyn'sh, A., 2660
Kalnyn'sh, A. I., 4975
Kalnyn'sh, A. Y., 4976
Kaltagova, M. G., 1545
Kamaliddin, A. R., 692
Kamihasai, K., 4608
Kamilova, R., 4609, 4610
Kamimura, M., 1952
Kamoshita, Y., 693, 694
Kampen, J. H., Van, 3392
Kampet, G., 4243
Kamphuis, G. L., 2661
Kamura, T., 1040
Kandle, R. P., 5060
Kaneko, R., 3537
Kannenberg, J., 2662
Kanno, I., 695, 696, 697, 4880
Kano, T., 250, 251, 1320, 1952, 5033
Kanwar, J. S., 698, 2663, 2664
Kaplinskii, M. I., 3538
Kaptein, L. A., 3389
Karev, N. V., 4434
Kargol, M., 73
Karianov, N. A., 3788
Karimov, T., 3789
Karlovskii, V., 4244
Karmon, Y., 4881
Karnes, L. B., 252
Karol, R. H., 1546, 1547
Karvitskii, M. P., 4611
Kaser, R. F., 1953
Kashanskii, A. D., 366, 4823
Kashayap, M. M., 699
Kassiff, G., 1548
Kataoka, J., 700
Katerinich, T. D., 3982
Kato, J., 1549, 1591, 1592, 1593, 1594, 1595, 1596
Kato, M., 701
Kats, N. I., 702
Kattan, A. A., 2665
Katz, M., 5061
Kaufman, R. I., 4658
Kaufman, W. J., 1321, 1322
Kavanagh, J. D., 1954
Kawada, N., 1174, 2984
Kawaguchi, K., 703, 715, 716, 2666, 4614
Kawaharada, R., 1550, 1551
Kazakov, V., 4245
Keller, J., 1955, 1956
Keller, W. D., 1323
Kellermann, J., 253
Kelley, W. P., 2667, 2668, 2669, 3790
Kellogg, L. W., 1957
Kelly, L. L., 1958, 1959
Kelmer, D., 704
Kelsall, D. F., 4246
Keltikangas, V., 4882
Kemper, W. D., 705, 706, 707, 708, 709, 1058, 2808
Kennedy, E. J., 1324
Kennedy, J. F., 1325, 1326
Kennedy, R. A., 710
Keppel, R. V., 1327
Kern, H., 2670
Kerr, F. F., 3791
Kerzum, P. A., 3607
Keso, L., 1960
Kevers, G., 254
Khainla, V., 2671, 2672
Khainla, V. E., 2673
Khairullin, S., 3129
Khan, M. A. H., 3619
Khan, S. H., 747
Kharin, A. I., 4675
Khavroshchenko, V., 3792
Khommik, K. T., 1961, 1962, 1963
Khovanskii, G. S., 1964
Khrenova, E. G., 4883
Khrustalev, V. M., 4848
Kibe, T., 379
Kichigin, V. N., 3793, 3794, 3795
Kidder, E. H., 2678, 3492, 4516
Kido, M., 2674, 2675, 2676
Kiefer, F. W., 2677
Kiehle, J. D., 3130
Kiehn, F., 1965
Kienitz, G., 1966, 3131
Kikuoka, T., 1552, 1967
Kikuya, A., 1383
Kim, A. G., 3796
Kim, C. K., 711
Kim, P. M., 4247
Kimura, D., 1328
Kimura, H., 723
Kincaid, D. R., 712
Kindingstad, E., 1329
King, A. L., 3797, 3798
King, K., 3132
King, K. M., 1117
King, L. G., 1968

King, P., 1969
King, P. H. T., 1970
King, R. D., 3799
King, S. M., 2678
King, V. G., 5029
Kingsbury, A. E., 4612
Kingsley, Q. A., 3390
Kinmont, R. M., 4613
Kinori, B. Z., 1330, 1971, 1972, 2679
Kira, Y., 2680
Kireev, A. F., 3800
Kirkham, D., 470, 588, 713, 714, 737, 838, 839, 876, 1022, 1029, 1030, 1498, 1844, 1845, 1846, 1973, 1974, 1975, 1976, 1977, 1978, 2030, 2031, 2032, 2216, 2311, 2343, 2854
Kirkland, C. J., 5062
Kirkpatrick, J. W., 3133
Kirtbaya, Y. K., 4248
Kirwald, E., 4977
Kiselev, M. V., 3801
Kiseleva, I. K., 3802
Kistenfeger, J., 4249
Kita, D., 715, 716, 4614
Kita, S., 3169
Kitamura, T., 1811
Kiuchi, T., 2681
Kizaki, S., 2289, 2290
Kizilova, A. A., 3803
Klawitter, R. A., 1206
Klein, F., 74
Kliavin'sh, I. I., 4978
Klinge, A. F., 717
Klingelhofer, K. R., 3540, 3566
Klingman, D. L., 4762
Klimko, A. I., 3304, 3391, 3539
Klimov, I. V., 4884
Klippert, V. I., 1979
Kloke, A., 1980
Klose, B., 4250
Klute, A., 462, 463, 718, 719, 720, 2224
Kluytenaar, J., 3488
Klyavin'sh, Y. Y., 1981
Klychnikov, V. M., 3804
Klyueva, K. A., 1331
Knapp, C. J., 4251, 4252
Knapp, J. W., 1332
Knisel, W. G., Jr., 1333
Knobloch, H., 1982
Knoop, F., 3134
Knowlton, G. F., 5063
Knust, H. G., 4253
Knutsson, G., 1334
Kobayashi, H., 721, 722, 3552
Kobayashi, J., 3516
Kobayashi, M., 1313
Koch, K. A., 3742, 3743
Kocherga, F. K., 4254
Kochev, K., 4788
Kochev, K. M., 1983
Kochi, T., 1174, 1175, 1176,2984
Kochkin, M. A., 3135
Kocialkowski, Z., 511
Kodani, Y., 723, 1553
Kodot, J., 1984
Koester, J., 4615
Koga, H., 2985, 2986
Koga, T., 654, 1062
Kohler, D., 4255, 4256
Kohler, M., 1985
Kohler, M. A., 1349
Koike, Y., 3805
Koivisto, A. A., 4257
Koivunen, T. M., 4897
Koizumi, A., 2979
Kojima, K., 4323, 4324
Koklyanov, A. F., 321
Kokot, J., 1986, 1987, 1988
Kokovin, E. V., 4258
Koldenhof, M. A., 1989
Kollist, P. I., 2682, 2683
Kolyasev, F. E., 724
Konaka, N., 230
Konakov, M. K., 3806
Kondner, R. L., 2205
Kondrashenko, A. K., 4494
Kondrat'ev, V. V., 3506
Konferentsiia poØlioratsii i Osvoeniiu Bolotnykh i Zabolochennykh Pochv., 4885
Koning, J. C. De, 725, 1805, 1990, 1991, 3392
Konno, I., 4850
Konno, K., 1044, 2901, 2902
Konno, N., 3169
Konstantinov, I. S., 3136
Konstantinov, V. K., 1992
Koo, R. C. J., 726
Kop'ev, E. I., 4259, 4260, 4261, 4262
Korhonen, K. H., 2684, 4616
Kornay, J., 4263
Korobchenko, Y. T., 2952
Kortooms, G., 5137
Kortum, F., 727
Korven, H. C., 2685
Kosac, S., 3137
Koshkin, V. V., 4617
Kostiakov, A. N., 1993
Kostov, M., 4264
Kostrzewa, S., 2686
Koszeghy, G., 3138
Kotsyuba, N. L., 3393
Kouno, H., 1553
Kovacs, G., 1554
Koval, L. I., 3139
Kovalenko, I. I., 4265
Kovda, V. A., 728, 1994, 3807, 3808
Kowalczyk, A., 255
Kowald, F. R., 1995
Koyama, T., 1040, 2687, 2688, 2689, 2690, 2691, 3809
Kozachyn, J., 729
Kozaliev, G., 4266
Kozel, J., 4979
Kozhanov, K. I., 4886
Kozhanov, K. Y., 1996, 1997
Kozlovskaia, L. S., 5003
Kozlovskaya, L. S., 2692
Kral, V., 4307
Kramer, 4618, 4619
Kramer, D., 4620, 4621, 4622
Krantz, B. A., 730, 2470
Krasnik, M. G., 4955
Kratynskii, V., 4267
Kraus, H., 4623
Krause, 1335
Krausz, N. G. P., 90
Kretchman, D. W., 4624
Kriel, A. F., 3810
Krigul, T., 2693
Krishnamoorthy, V. S., 2642
Krishnan, R. H., 3140
Kristensen, E., 3811
Kristensen, K. J., 386, 387, 5138
Kristiansen, K., 1998
Krivonosov, L. M., 256
Krochin, S., 4625
Krohn, J., 3812
Krolis, K. E., 4268
Kropper, H. J., 1336
Kroth, E. M., 683, 731, 732
Kruijff, G. D., 75
Krumbach, A. W., Jr., 467
Krumin'sh, K. A., 733
Krupkin, P. I., 2694
Krupnova, G. F., 4887
Kruse, E. G., 1999
Kruse, G., 1295
Kruse, G. E., 2000
Krustev, N., 5139
Krylov, M. M., 734
Kryukov, L. G., 4394
Kryzhanovskii, A. I., 4269
Krzyszowski, J., 1337
Krzywonos, K., 3813
Ksenofontova, V. V., 1478
Ku, P. C., 4462
Kubota, S., 2695
Kubyshkin, P. P., 257, 4980
Kucheryava, L. F., 735
Kuczarow, W., 736
Kuder, G., 3141
Kuhlman, A. R., 897
Kuiperi, H. G., 1402
Kulen, M., 2001
Kulkarni, D. G., 3814
Kummer, F. A., 3052
Kuusela, K., 2622
Kunkle, G. R., 1338
Kuntze, 4888
Kuntze, G., 2696
Kuntze, H., 258, 259, 260, 2002, 3394, 4270, 4271, 4273, 4274, 4275, 4626
Kunze, R. J., 714, 737, 738
Kupchinov, N. N., 2697
Kuperman, E. S., 4105
Kuratorium Fur Kulturbauwesen, 76, 77
Kurbatov, N. D., 4276
Kurkus, Y., 78
Kurm, H., 739

Kurm, K., 1107
Kushman, L. J., 2698
Kusse, A. D., 1314, 2003, 2004
Kutera, J., 2699
Kutilek, M., 740
Kuvshinov, I., 5140
Kuwano, S., 1555
Kuwano, Y., 4880
Kuz'michev, V. E., 4277
Kuz'mina, K., 1184
Kuzmak, J. M., 741
Kuznets, J. M., 3815
Kuznetsov, N. I., 3816
Kvarnemo, L., 2700
Kwarta, C., 436
Kwinichidze, M., 2701

Laar, H. J. Van De, 4627
Laasimer, L., 1107
Labye, Y., 2005
Ladefoged, K., 2702
Ladewig, J. E., 5034
Lagerwerff, J. V., 2703, 2704
Lagunova, E. P., 742
Lakovlev, N. I., 2705
Lakshmipathy, B. M., 3142
Laktionov, B. I., 3817
Lall, S., 1339
Lamb, O. P., 2274
Lambe, T. W., 1556
Lambor, J., 2006
Landers, R. H., 3143
Landt, E., 79, 80
Lane, E. W., 2007
Lang, A. L., 3403
Lang, H. C., 482
Lang, P., 4278
Langa, J. M., 3144, 3145
Langan, L. N., 827
Langbein, W. B., 1340, 1341
Langewiesche, W., 1342
Langford, T. R., 4628
Lapitskii, I. I., 2706
Laptev, V. N., 2238, 3818
Lara-Nieto, J. De, 81
Larin, I. V., 2707
Larsen, E., 261
Larsen, H. L., 1915
Larsen, N. J., 4981
Larsen, S., 4279
Larson, C. L., 82, 1891, 2008, 2009, 2010, 2011, 2012, 3113, 3541, 3542, 4280
Larson, J. E., 2601
Larson, N. G., 3819
Larson, W. E., 407, 1840, 2013
Laskowski, S., 2708
Lastochkin, D. S., 3820, 4629
Lastochkina, L. A., 4630
Latham, B. M., 3146
Lauciani, E., 262, 3821
Laudencia, P. N., 3691
Laurand, J., 1343, 5141
Laurand, Y. K., 5142
Laurenson, E. M., 2014
Lauritizen, C. W., 4210, 4281, 4631, 4632, 4633, 4634, 4635, 4636,4637, 4638, 4639, 4640, 4641, 4642, 4643, 4644, 4645
Laursen, E. M., 2015
Laverton, S., 4889
Lavrov, A. V., 4890
Lawhon, L. F., 3147, 3941
Lawler, E. A., 1557
Lawless, G. P., 743, 845, 846
Lawrence, J. M., 4519, 4646
Lawson, M., 666
Leach, H. D., 2016
Leamy, M. L., 744
Lebedeva, G. F., 2743
Lebedevich, N. F., 2709
Lee, B. F., 4647
Lee, F. S. Y., 2017, 2018
Lee, S. M., 3822
Lee, W. O., 4761
Leech, A. P., 1065, 2215
Leendertz, B., 4335
Leenheer, L. De, 432, 471, 819, 1344
Lees, P. M., 2019
Legerwerff, J. V., 2709
Legg, J., 3662
Legostaev, V. M., 3823, 3824, 3825, 3826
Lehmann, T., 2020, 4282
Lehr, J. H., 3543
Leiby, M. G., 147
Leidel, H., 74
Leitman, B. G., 263
Leliavsky, S., 1558, 1559, 1560
Lely, G. Van Der, 3544
Lembke, W. D., 2021, 2022, 2710
Lemke, A. E., 5071
Lemon, E., 2711
Lemon, E. R., 745, 746
Lencastre, A., 2023
Leningrad. Severnyi Nauchno-Issledo-Vatel'skii Institut Girotekhniki I Melioratsii.,2024
Leo, M. W. M., 2712
Leonard, R. L., 1345
Leonards, G. A., 1561
Lerner, S., 3827
Lesser, F. H., 5043
Letunov, P. A., 3828
Letey, J., 689, 2713
Leue, P., 264
Leur, D. A. Van De, 1346
Leushev, A. N., 2025, 2714, 3496
Leutheusser, H. J., 2026
Levakov, V., 3829
Levanovskii, L. B., 265, 266, 312, 321, 2027
Levee, W. M., 747
Leven, J. A. Van't., 2376
Leverington, K. C., 748
Levin, M. G., 3497, 4232
Levine, G., 444, 976
Lewandowski, A., 3395
Lewis, D. C., 4648, 4719, 4720
Lewis, G. C., 691, 749, 864, 895, 961, 2715
Lewis, M. R., 3830
Leyton, L., 2716
Lhota, O., 783
Lhotsky, J., 267, 4283
Li, C. H., 1347
Li, C. M., 268
Li, L. C., 1123, 3831, 4058
Li, S. C., 2028
Li, W. H., 2029
Lie, O., 4284, 4891, 4892
Liebing, U., 1965
Lifshits, E. A., 3832
Liger, P., 269
Lightfoot, L. C., 750
Ligon, J. T., 1846, 2030, 2031, 2032
Liljedahl, J. B., 3470
Lillandt, S., 4285
Lillard, J. H., 1233, 2356, 3255, 3256,
Lilleland, O., 2717
Lin, C. L., 148
Linehan, P. A., 2719
Lingsma, J. S., 5143
Lint, H. Van, 271, 272
Lindberg, H. R., 1348
Lindberg, K., 4982, 4983
Lindner, H., 751
Lindqvist, R., 270, 2718, 3833, 3396, 4286, 4650
Linford, A., 2033
Linsley, R. K., 1562
Linsley, R. K., Jr., 1349
Linthorst, T. J., 2034
Lipatov, K. G., 2035
Lipps, R. C., 2562
Liptak, F., 4651
Lisin, S. S., 5024
List, E. J., 2036
Listo, T., 4287
Little, W. C., 1669, 3148
Liu, C. M., 3545
Liu, H. K., 2037, 2038
Liu, T. C., 2957
Liu, T. T., 752
Liu, Y. C., 1123, 4058
Livermore, D. E., 3149
Livesley, M. C., 273
Livingston, A. C., 4288
Liwski, S., 780
Lloyd, D., 4289
Lloyd, R. D., 827, 2039
Lluch, F. E., 274
Lo, A. H., 753
Loayza, G. C., 3397
Lobanov, I., 4652
Lochen, A., 83
Lockert, K., 4290
Lockhart, J. M., 4291
Loddesol, A., 754, 2720,4893
Loebell, 4292
Loebell, R., 4293
Loehnberg, A., 3834
Lofgren, B. E., 4653
Loftin, L. L., 764, 765
Lofton, K. T., 3835
Loftsgard, L. D., 134
Loginov, M. M., 4654
Lohr, G., 84

Loiter, M. N., 85
Long, A. A., 3836
Long, F. L., 755, 756, 3234
Long, G. L., 1421
Long, H. H., 1350
Longenecker, D. E., 757, 3839
Longwell, T. J., 758
Longworth, L. D., 3150
Look, E. H., 4294
Lopatnik, J., 3837
Loreen, E., 1351
Lorenz, P., 2212
Lotan, A., 3151, 3152, 3153
Loughry, F. G., 759, 2721
Low, D. E., 1832, 1833
Low, P. F., 760
Lowe, J., 2719
Lowitz, C. A., 4604, 4605
Lowndes, A. G., 2040
Lowry, G., 1761
Lubiako, E. I., 2041
Lubiako, G. N., 2042
Lubianyi, N. I., 3838
Lucas, C. V., 4814
Lucas, R. E., 518
Luden, B., 4986
Ludwig, H. F., 2043, 2754
Luik, H., 3398, 4295
Lujic, R., 2044, 3154
Luken, H., 762, 2722, 2723
Lukkala, O. J., 4984, 4985
Lull, H. W., 2724
Lund, R., 3791
Lund, Z. F., 763, 764, 765, 965
Lundgren, H., 2045
Lunin, J., 1677, 2449, 2508, 2569,2890
Lupinovich, I. S., 766, 767, 2735
Lusby, G. C., 974
Lusczynski, N. J., 1352
Lushchikhin, N. N., 2046
Lustig, H., 4894
Luthin, J., 2208, 2725, 2726, 2727, 2728, 2729, 2730, 2731, 2732, 2733, 2734
Luthin, J. N., 466, 768, 906, 1429, 1503, 1617, 1695, 1739, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2217, 2300, 2302, 2393, 3490, 3546, 3547, 4074
Lutz, G. A., 4524
Lutz, J. F., 708, 2736
L'vin, N. S., 3155, 4296
Lyerly, P. J., 757, 2737, 3839
Lyles, L., 2554, 2738, 3156
Lynch, R. G., 5064
Lynn, W. C., 2644
Lyons, T., 3399

Ma, H. H., 482
Maasland, D. E. L., 709
Maasland, M., 769, 2055, 2056, 2057, 2058, 2485
Maastik, A., 2230
McAlister, J. T., 3157
McAllister, D. R., 2816
McAlpine, R. G., 2739
Macau-Vilar, F., 2059
McBroom, J. T., 5065
McCart, R., 4655
McCool, D. K., 2060, 2061
McDaniels, L. I., 1585
McDonald, H. R., 1353
McDougald, J. M., 2963
MacFarlane, I. C., 770
McGaughey, P. H., 2740
McGeorge, W. T., 2489
MacGillivray, N. A., 743, 5066
MacGillavry, C. J., 5144
McGuinness, J. L., 550, 640, 771, 772, 1292, 1354, 1355, 1356
McHenry, J. R., 729, 773, 774, 775, 1357, 1358
Machmeier, R. E., 2009
McHughs, J. H., 1274
McIlroy, I. C., 776
McIntyre, A. M., 4656
MacIntyre, I. M., 4297
McIntyre, R. R., 1359
MacKay, D. C., 2921
McKeag, J. A., 3840, 3841
McKeever, I., 3158
Mackenzie, A. J., 796, 2421, 2470, 3400
McLean, E. O., 2518
McLean, R. D., 3401
McMartin, A., 2062
Macnair, A. S., 86
McNeary, S. S., 2063, 2180
McNown, J. S., 1563
McRae, E. A., 3159
McSwain, K. R., 4657
McVey, J. L., 3742, 3743
Madrowa, M., 3395
Maeda, T., 2400, 2534
Magee, R. A., 631
Magi, K., 2741
Mahn, F., 3812
Mahood, H. E., 2742
Mai, C. C., 2277
Maiana, A., 849
Maianu, A., 3842, 3843, 3844, 3845, 3906, 3907
Maierhofer, C. R., 2064, 2065, 3846, 3847, 3848
Maijala, K., 87, 4298, 4299
Maike, P. M., 4300
Makarov, V. T., 2743
Makarova, G. F., 2744
Makharadze, A. A., 3402
Makhkamov, K., 4301
Makhno, G. F., 3849
Maki, T. E., 2745, 4987
Makkink, G. F., 777, 778
Makowski, J., 779
Maksimiuk, G. P., 3850, 3851
Maksimow, A., 780
Malaika, J., 3852
Malcolm, C. V., 750
Malecki, W., 2066
Malek, J., 4988
Malherbe, I. DeV., 275
Malicki, M., 531
Malinovskii, G. A., 1360
Mallick, I. A., 3678
Malmerot, B., 4302
Malmstrom, C., 4895
Maloney, F. M., 88
Maltabar, L. M., 3160
Malygin, V. S., 3853
Mamack, W., 1361
Mamaev, S. A., 5145
Mamedov, A., 4303
Mamisao, J. P., 2067
Manarpaac, V. T., 900
Manbeck, D. M., 2010, 2011, 2012
Mandal, L. N., 2531
Mandel, S., 628, 1362
Manges, H. L., 4219
Manley, P. L., 4304
Mann, D. E., 89
Mann, F. L., 90
Manrai, G. K., 2759
Manson, P. W., 91, 1363, 1655, 1656, 2068,2069, 2070, 2217, 2220,4305, 5067
Mansur, C. I., 1582, 1583, 1584, 4658, 4772
Manville, R. H., 5068
Mao, S. W., 2071, 2072
Mara, 430
Marais, P. G., 781
Maran, B., 782, 783
Marcinek, J., 494, 2701
Marcus, G., 3854
Marcus, H., 1564
Marcussen, N., 5146
Marel, H. W. Van Der, 670
Marias, P. G., 784
Marin, S., 92
Maris, A. G., 1364
Marjai, G., 4659
Markov, E. S., 2073, 2074, 2755
Markov, P. V., 1365, 4306
Marr, J. C., 4660
Marrero, J. F., 3161
Marsh, A. W., 365, 785, 1021, 3758
Marshall, T. J., 620, 786
Marston, R. B., 787, 1293, 1366
Martens, B. K., 376
Martin, C. K., 788, 3403
Martinetti, R., 4661
Martinez, A., 313
Martinez, E. R., 276, 2075, 2076
Martinez, L. A., 3855, 3856
Maruyama, T., 1952
Maryland University, Agr. Ext. Serv., 93
Masek, V., 4307
Maslarzowa, B., 277
Maslov, B. S., 2077, 2746, 2747, 3404, 3857
Maslova, A. A., 2748
Mason, W. A., Jr., 3130
Mathey, N. A., 3858
Mathieu, A. L., 789
Mathrani, M. P., 1367
Matiunin, N. F., 790

Matsepuro, M., 4308, 4309
Matsepuro, M. E., 4310
Matsubara, S., 2078, 2079, 3859
Matsumi, S., 2749, 2750, 4852, 4896
Matsumoto, N., 2869
Matsuo, H., 791, 792, 793
Matsuo, M., 4323, 4324
Matsuo, Y., 2666
Matsuoka, Y., 2869
Matsushita, F., 2080, 2081
Matsusita, K., 1038
Matsuzaka, Y., 794
Matthews, B. C., 1906
Matthews, J., 4311
Mavrocordat, G., 3860
Mayer, P. G., 2082
Mayhew, J. K., 4662
Mayo, K. L., 2083, 4312, 5035
Mazing, V. V., 2751
Mazloum, S., 3861
Mazurak, A. P., 795
Mazzini, C., 4313
Means, R. E., 1565
Medelana, D. R. D., 3162
Medlock, O. C., 3163
Medvedeva, V. M., 2752
Meek, B. D., 796
Meer, K. Van Der, 797
Meerson, G. M., 2084
Mehnert, K., 156, 4314
Mehrotra, C. L., 3592, 3999
Mehrotra, N. K., 2423
Mehta, M. L., 3862
Meijering, K., 278
Meijers, P. G., 798
Meinguet, J., 2247
Melacrinos, A., 3906
Mello, A. T. De., 2753
Mel'nikov, V. M., 4084
Melsted, S. W., 579, 581
Mendes, F. D. S., 2085
Mendizabal, M., 3863
Mendoza Von Borstel, F., 1368
Menz, J. A., 94
Mer, I. I., 4315, 4316, 4317
Merbitz, 4318
Merbitz, H., 95, 279, 280, 2086, 4663
Merbitz, J., 281
Merculiev, O., 3658
Meriaux, S., 799
Merikhein, A. I., 4989
Merite, B., 377
Merkur'ev, I. S., 4319
Merlescu, E., 464
Meron, A., 2754
Merriam, R. A., 800, 801, 802, 803
Merrill, C. L., 3864
Mersereau, H. E., 2087
Meshcheriakov, D. P., 2755
Meshcheryakov, D. P., 5126
Meshechok, B., 2756, 4990, 4991, 4992
Messina, U., 4320
Mesu, F. P., 5147
Metcalf, L. R., 2366
Metsanheimo, U., 2757
Metz, R. C., 1369
Meyboom, P., 1370
Meyer, C. B., 3865
Meyer, J. L., 2088, 3405, 3547
Meyer, L. D., 3008, 3014
Meyers, L. E., 1513
Meylan, B. A., 804
Meyle, W. A., 3622
Micheljak, E., 4664
Mickelson, R. H., 405, 805, 960, 1212, 1213, 2843, 2844
Middleton, R. V. D., 2089
Midgley, A. R., 1371
Mido, K. W., 1241
Miears, R. J., 3072
Miers, R. H., 3406
Mihalache, L., 3164, 3165
Mihalic, V., 3465
Mika, Z., 3407
Mikhailichenko, V. N., 3866
Mikhailov, M. N., 420
Mikhkiev, A. I., 4897
Mikhovich, A. I., 4993
Miklich, F. J., 602
Mikola, I., 4898
Milanov, T., 806
Milchev, M., 3244
Milchev, M. P., 2090, 2091
Milev, V., 3867
Miljkovic, N., 807
Miller, A. E., 1372
Miller, C. R., 1373
Miller, D. E., 808, 809, 810, 811
Miller, D. G., 2070
Miller, H. W., 3868
Miller, J., 3166
Miller, M. D., 3587, 3728
Miller, M. P., 2499
Miller, R. D., 428
Miller, R. J., 836, 837
Miller, W. T., 4321
Millerov, K. V., 4617
Milligan, C. H., 1926, 3548
Milliman, J. W., 96
Milne, R. A., 456, 2338, 4034
Milojevic, M., 3549
Milyauskas, V., 2758
Minaev, I. V., 3550
Minashina, N. G., 812, 3869
Mingalieva, A. Z., 3870
Mingazzini, C., 1566
Minkina, T. I., 2783
Minshall, N. E., 1374
Mirajgaoker, A. G., 2092
Mirchandani, P. M., 2759
Mirkin, S. L., 4899
Mirsagatov, A. N., 4105
Misono, S., 813, 814
Misra, S. G., 3871
Missouri Agricultural Experiment Station, 2093
Mitchell, L. R., 1241
Mitin, V. F., 3408
Mitkees, A. I., 3719
Mitra, S. P., 2760, 2761
Mitskis, R. M., 4665
Mitsuta, M., 1549, 1590,1594
Miyamori, N., 1810
Miyasaka, A., 2687, 2688, 2689, 2690, 2691
Miyazaki, N., 1809, 2750, 4850, 4851, 4852
Moar, N. T., 815
Mochalov, I. P., 4666
Mock, F. J., 2206
Moe, D. L., 4322
Mogoryanu, N., 1405
Moh, Z., 1567
Mohammad, G., 3872
Mohan, Y., 3873
Mohanty, P. K., 2149
Mohrmann, J., 3409
Moinuddin, M., 3874
Molen, W. H. Van Der, 97,3875
Molin, M., 4667
Molinari, C., 2141, 4668
Moller, C. M., 4994
Molodtsov, V. A., 816
Molof, J. J., 3876, 3877
Moltesen, P., 282
Momozumi, T., 2313
Monhemius, L., 3551
Monke, E. J., 2022, 2094
Monolts, 4669
Montanari, V., 2762, 4002
Montgomery, R. C., 283
Moodie, C. D., 3764
Moore, C. M., 1375
Moore, W. L., 2095
Moran, P. A. P., 1376
Morant, R. De, 2096
Mordeno, A. G., 2097
Morel-Seytoux, H. J., 2098
Morgan, A., 3410
Morgan, C. W., 2095
Morgan, P. E., 1377
Mori, H., 4614
Morisawa, M., 1383
Morisawa, M. E., 1378
Morishima, S., 4323, 4324
Morita, H., 1379
Morooka, M., 3552
Morozov, A. T., 2099, 3878
Morozov, V. K., 3879, 4085
Morris, H. D., 756
Morris, H. M., 2100, 2101, 2102
Morrison, M. E. S., 817
Mort, G. W., 3167
Mort, H. D., 4670
Mortensen, J. L., 647, 2610
Mortier, P., 432, 818, 819
Morton, H. L., 2591
Morton, P. W., 98
Moser, B. D., 1380
Mosienko, N. A., 4325
Mosonyi, E., 1381
Motin, Y., 4543
Motoc, M. D., 2103
Motomura, S., 820
Moulder, E. A., 1315
Moustafa, A. E. H. I., 821
Muckel, D. C., 2346, 2763, 4326
Mueller, K. E., 4648, 4649

Mueller, O., 3411
Muijen, J. C., 5148, 5149, 5150
Mukai, M., 380
Mukhamedgaliev, K. M., 3880
Mukhin, L. M., 822
Mukhitdinov, U., 4610
Mulhern, T. D., 5069
Mulkey, J. R., Jr., 2764
Muller, F., 5151
Muller, W., 4900
Muller-Feuga, R., 4505, 4671
Mulligan, H. P., 488
Mullins, T., 4572
Multamaki, S. E., 2104
Muotiala, S., 5152
Muradov, A. S., 823
Muraoka, S., 1595
Muraoka, Y., 4816
Murashko, A. L., 3500
Muratkhan, V. P., 256
Muratova, V. S., 728, 3881
Muravsky, E., 3882
Murayama, T., 2868
Murdock, J. T., 500
Muresan, D., 3168
Murr, L., 824
Murray, J. A., 2105
Murray, J. M., 825
Murthy, A. S. S., 3883
Murthy, R. S., 898
Musgrave, R. B., 2420
Musha, T., 3809
Mustoe, N. E., 99
Musya, T., 2690, 2691
Muzychuk, I., 3412
Myagi, K. A., 2106
Myer, V. I., 2509
Myers, D. J., 3413
Myers, J. M., 1252, 2765
Myers, L. E., 826, 1098, 1382, 1670, 3884
Myers, L. E., Jr., 2107, 4672, 5070
Myers, V. I., 827, 2039, 2108, 2109, 2766, 3326, 3885, 3886, 4368
Myhre, D. L., 2110
Myles, G. A., 4701
Mylvaganam, T., 2111

Naas, O., 828
Naddih, B. I., 2644, 2645
Nagahori, K., 4550, 4551
Nagaishi, Y., 1596, 2398, 3738
Nagaraja, V. N., 5153
Nagasaki, A., 1164, 3414, 3458, 3459
Nagata, N., 1162
Nagata, T., 3887
Nagatsuka, S., 794
Najim, H. T., 3888
Nakagawa, S., 1320, 1952, 5154
Nakahara, M., 3805
Nakamura, C., 3169
Nakamura, T., 2776
Nakane, M., 4852
Nakano, H., 1383
Nakarara, M., 2985, 2986
Nakashima, S., 2777
Nakaya, M., 1568
Nakayama, F. S., 680, 1384
Nambu, S., 3249
Namiki, K., 2978
Namken, L. N., 4093
Nanba, N., 4816
Naor, I., 1385
Napel, C. T., 2112
Napel, G. T., 1989
Narain, J., 1561
Narayanaswamy, S., 3142
Narbaev, K., 3889
Natal'in, B., 1386
Nath, B., 3890
Nathan, K., 829, 2113, 3415
National Institute of Agricultural Engineering, 4327
National Reclamation Association, Proceedings of the Twenty-Fourth Annual Meeting, Lincoln, Nebr., 3891
National Reclamation Association, Proceedings of the Twenty-Fifth Annual Meeting, Salt Lake City, Utah, 3892
Navqvi, N., 3678
Naylor, P. E., 3893
Nazarov, M. I., 2114
Nazaruk, G., 2115
Neagu, G., 2152
Near East-South Asia Irrigation Practices Seminar Helmand Valley Delegation, 5155
Nechetov, G., 4328
Neeley, W. W., 4568
Nefedov, V. D., 3894, 4742
Nefedov, V. V., 284
Neill, C. R., 2116
Nekrasova, A. A., 3160, 3170
Nelson, C. E., 2827
Nelson, H. C., 2275
Nelson, H. T., 1387
Nelson, J. L., 2778
Nelson, R. W., 830, 831, 2117, 3416
Nemchinov, A. A., 832
Nemec, J., 2118
Nerozin, A., 3895
Nesterenko, I. M., 4277
Nesterou, V. E., 403
Nesterova, G. S., 2779
Netherlands Directie Van De Landbouw, 285
Netherlands Directie Van De Wieringermeer, 5156
Neto, J. A., 3171
Neudecker, J., 3417, 3896
Neumeyer, 4673
Neuwinger-Raschendorfer, I., 833
Nevano, G., 2119
Neves, J. B., 2120
Neves, J. R. B., 3897
Neveux, M., 3898
Newman, J. S., 998
New Mexico State University Agricultural Extension Service, 2780
New South Wales Soil Conservation Service, 3172
Newton, D. W., 1388
Neznaev, M. F., 2781, 4258
Nickels, N., 4901
Nichols, M. R., 100
Nicholson, A. J., 3173
Nicholson, R., 834
Nichoson, H. H., 3899
Nicolau, M., 3860
Nicoli, A., 1205
Nielsen, D. R., 515, 516, 517, 680, 835, 836, 837, 838, 839, 1099, 2121, 3647
Nielsen, P. K., 5157
Nielsen, T. P., 286
Nieman, R. H., 2782
Nienaber, H., 4674
Nijensohn, L., 840, 841
Nijhawan, S. D., 3900
Nikitin, A. G., 3901
Nikolaev, A. V., 842
Nikolaev, I. I., 4675
Nikonov, M. N., 843, 2783, 2992
Nilsson, L., 513
Nilsson, R., 3418
Nir, A., 627, 628
Nishanen, M., 4329, 4330, 4995
Nishide, T., 594
Nitsenko, A. A., 844
Nixon, P. R., 743, 845, 846
Nizon, P. R., 1100
Nobe, K. C., 1389
Noce, G. D., 1390
Noest, J., 4902
Nolte, B. H., 2122, 2123
Nonaka, S., 3174
Norden, A. J., 2784
Nordin, C. F., Jr., 1391
Norrgard, A., 287
North Rhine-Westphalia, 3419
Northern Ireland, Ministry of Agriculture, 3420
Norton, J. S., 4676
Norum, E. M., 2124
Nosenkov, A. I., 847
Noskova, A. V., 2706
Nosov, A. V., 4331
Novak, B., 848
Novikoff, G., 288
Novikov, M. I., 4903
Novikova, A. V., 3902, 3903, 3904
Novikovskii, V. E., 4677
Numminen, E., 2785, 4332, 4333, 4996, 4997

Obbink, J. G., 4334
Obermeier, H. C., 289
Obezmuradov, B., 3905
Obminski, Z., 4998
Obrejanu, G., 849, 850, 3906, 3907

Obukhov, A. D., 1392
O'Byrne, J. C., 135
Ochiai, T., 851, 1569
Oda, K., 379
O'Daniel, W., 4335
Odegaard, M. L., 4904, 4905
Odell, R. T., 579, 581, 1143
Odins, J. J., 4999
Odynsky, W., 903
Offengenden, S. R., 290, 2125, 5158
Oganesian, A. P., 852
Oganezon, G., 3553
Ogata, G., 920, 921, 2704
Ogata, H., 2126
Ogata, S., 2637, 2638, 2639, 2640
Ogawa, K., 2767
Ogawa, T., 2127
Ogawa, Y., 2313
Ogayu, K., 3887
Ogleznev, A. K., 1182
O'Grady, L. J., 2768
Oh, W. K., 985
Ohama, F., 4678
O'Hare, P. J., 4943
Ohashi, W., 2868
Ohmstede, W. D., 2128
Ohrstrom, A., 101
Ojefors, E., 1393
Oka, A., 4816
Okajima, H., 2769
Okruszko, H., 780, 853, 854, 2770, 4847, 4906
Okuda, A., 2771
Olbertz, M. H., 2129, 3421, 4336, 4337, 4365, 4679
Olenin, A. S., 855
Olerinskii, V., 2130
Oliferov, A. N., 3175
Oliveira-E-Sousa, E., 3908
Olivercrona, C. M. B., 4680
Ol'khovskii, I. A., 4338
Olkowski, M., 856
Ollos, G., 2131, 4651
O'Loan, J., 102, 103
Olofsson, S., 4907
Olsen, O. B., 4681
Olson, A., 134
Olson, E. O., 2527
Olson, T. C., 1031, 1032
Olszewski, Z., 857
Olteanu, V., 3119
Omelin, N. N., 2132, 3554
Onchukov, D. N., 858
Oncescu, M., 383
Onea, T., 3168
O'Neill, J. L., 291
Ongaro, G., 2772
Onishchenko, B. P., 1394
Onishi, H., 1952
Onikura, Y., 1080, 1081, 2928
Ono, H., 3909
Ono, S., 1038, 1039
Onogi, M., 722
Oosterkamp, J. L., 2133
Oprea, C. V., 3910
Ordoveza, J. L., 2134, 2135, 2773
Orlob, G. T., 859, 1322, 2740
Orlov, A. I., 2774
Orlovskii, N. V., 860
Oroszlany, I., 3911
Ortiz-Valez, J., 3586
Osborn, J. F., 861
Oseledets, N. N., 3912
Osipov, V. I., 566
Ostapchik, V. P., 3913
Ostendorf, F. W., 3555
Ostholm, C. O., 3355
Ostromecki, J., 2136, 2137, 2775, 4339
Ostroumov, S., 5000
Ostrowski, S., 5001
Ota, K., 1313, 2138, 3914
Otte, R. C., 104
Ou, Y. A., 1395
Ouwerkerk, J. H. Van., 2139
Ovchinnikov, V. V., 4340
Overholt, V., 3422
Overstreet, R., 392, 2442
Overwater, C., 3915
Ow, R. Von, 4191, 4192
Owen, W. H., 2140, 3176
Owen, W. J., 1289, 1433
Oyama, M., 862
Ozersky, E., 4083
Ozgul, S., 2001
Oztan, B., 3916

Paarlahti, K., 2786, 2787
Paassen, J. T. M., Van, 314
Paavilainen, E., 863
Packer, R. J., 1396
Padoan, G., 2141, 4682
Padoms, A. I., 4341
Pagay, S. N., 2162
Page, J. B., 424
Page-Hanify, D. S., 591, 592
Paicao, J. D. C., 4683
Pair, C. H., 864
Paivanen, J., 4342, 4862
Pak, K. P., 3611
Palfai, I., 4343
Palikko, E., 2142
Palmer, D. B., 4344
Palmer, M. L., 4345
Palmer, R. S., 4684
Panadiadi, A. D., 290
Panasenko, P. D., 4346
Panenko, I., 3423
Panifilov, V., 3917
Panin, P. I., 3918
Panin, P. S., 3919
Pankov, P. I., 3556, 3557, 3558
Pantastico, E. B., 900
Panteleeva, N. N., 865, 4347
Papadopulos, I. S., 3530
Papendick, R. I., 1133
Papp, B., 866
Parcher, J. V., 1565
Parkash, V., 3702
Parker, F. L., 1397
Parker, G. G., 1398
Parks, W. L., 758
Parr, J. F., 867
Parrish, F. J., 1906
Parsons, D. A., 1399, 1400
Parvet, A., 2143
Parys, A. Van, 4908
Pasa, V., 3906, 3907
Pasini, B., 3177, 3424
Pathak, N. K. S., 1050
Patil, B. D., 3178
Patnaik, S., 2422
Patric, J. H., 992
Patrick, R., 3471
Patrick, W. H., Jr., 868
Pattimore, E., 3425
Paulhus, J. L. H., 1349
Paulus, A. O., 2989
Pavlovskii, A. A., 4348
Pearce, G. A., 4685
Pearson, G. A., 2788, 2789, 2790, 2791, 2792, 2793
Pearson, H. E., 2794
Pearson, R. W., 2795
Pechkurov, A. F., 3920
Peck, R. B., 1506
Pedrero, J. J., 2144, 2145, 3426
Peech, M., 2804
Peele, T. C., 869
Peerlkamp, P. K., 870
Peev, B., 3179
Peiris, H. C., 4349
Pekatoros, L. G., 2146
Pelishek, R. E., 861, 2158
Pellizzi, G., 4350
Peltola, J., 105
Pemberton, E. L., 1401
Pena, I. De La, 3921
Pena, R., 3180
Pendleton, R. A., 292
Penny, J. M., 4686, 4687
Penskoi, I. K., 293, 2147
Pepper, J. H., 3698
Pereira, H. C., 871
Perekhrest, S. M., 872, 2148,3922
Perenyi, K., 4688
Pereverzev, V. N., 2796
Perez-Bryan-Lopez, M., 1615
Perez-Escolar, R., 3665
Perigaud, S., 3923
Perk, G. D., 1402, 4689, 5159
Perrey, J. I., 1403
Perrier, E. R., 517, 690, 838
Pershina, M. N., 873
Persson, S., 4351
Peshekhonova, N. F., 3924
Pessi, Y., 2797, 4909
Peters, D. B., 397, 640, 738, 874, 2224
Petersen, J. S., 3559
Petersen, R. G., 966
Peterson, A. E., 3030
Peterson, D. F., 2149, 4808
Peterson, D. F., Jr., 2150, 2151, 2413, 3560, 3561
Peterson, D. G., 3181
Peterson, H. B., 2510, 4018

Petinov, N. S., 3924
Petkov, P., 609
Petlakh, Y. S., 4352
Petrash, D. N., 3160
Petrescu, N., 2152, 3658
Petrescu, S. N., 106
Petrosian, G. P., 3925
Petrov, E. G., 875, 3926
Petrovich, D., 4400
Petrunya, N. I., 2798
Peynalo, A., 2527
Phagan, C. V., 3197
Phelan, J. T., 2153
Philip, A. W., 2154
Phillips, R. E., 876
Phillips, R. L., 3182, 3183
Phelan, J. T., 3734
Phillis, E., 877
Piacco, R., 3927, 3928
P'iavchenko, N. I., 4910, 4911, 5002, 5003
Pichler, J., 1381
Pickard, W. F., 2155, 2156
Pickering, Q. H., 5071
Pierce, R. S., 477, 1417
Pietka, Z., 2006
Piironen, J., 4353
Pillsbury, A. F., 689, 1699, 1925, 2157, 2158, 2159, 3384, 3669, 3929, 3930, 3961
Pinchuk, M. G., 5004, 5005
Pinto, J. F. R., 1404
Piper, B. M., 3427
Pisarenko, A. J., 3184
Pisarenko, E. P., 3192
Pisar'kov, K. A., 263, 2160, 2799
Pishchikov, B., 4090
Piskarev, A. N., 3170
Pizer, N. H., 2800
Plantie, L., 3185
Plyusnin, I. I., 294, 2801
Pochvennyi Institut Imeni V. V. Dokuchaeva, 295, 2802, 3931
Podstavek, B., 4690
Podymov, B., 1405
Poenaru, I., 3251
Poenescu, M., 3754
Poggiolini, G., 4691
Pogosov, P. S., 2161
Pohl, E., 5160
Poiree, M., 3428
Poland, J. F., 1406, 2803
Politov, A. K., 4692
Pollard, A. G., 1125
Polli, L. A., 5006, 5007
Polovitskii, I. I., 3680
Pol'skii, M. N., 878, 3708
Polubarinova-Kochina, P. Y., 1407
Poluboryarinov, I. I., 257
Pompa, P. G., 3186
Poncet, A., 5008
Ponimash, P. I., 3187
Ponnamperuma, F., 2804
Pons, L. J., 651, 879, 880, 2650
Popa, C., 2997
Popa, V., 3188
Popescu, V., 3168
Popov, A. A., 3932
Popov, K. V., 4354
Popov, O. S., 4355
Popov, O. V., 881
Popov, T., 3189
Popova, V. L., 420
Popova, Z. P., 2990
Popovich, P. D., 3190
Popp, N., 882
Porter, H. L., 3191
Porter, L. K., 709
Porterfield, W. A., 4721
Portland Cement Association, 3429
Posey, C. J., 2162, 2164
Poslavskii, V. V., 5161
Post, C. J. Van Der, 2163,3430
Post, J., 4356
Post, J. J., 296
Postlethwaite, J. D., 883
Postnikov, B. A., 4116
Potapov, F. M., 1408
Pough, R. H., 1409
Powell, D. P., 1014
Powell, R. W., 2164
Powers, W. L., 1410
Pratt, P. F., 884, 2599, 2669, 2805
Prenk, J., 885
Preobrazhenskaya, M. V., 3933
Preobrazhenskii, T., 3934
Preside, G. L., 297
Press, H., 298, 1411, 3935
Pressi, Y., 4912
Prettenhoffer, E., 3936
Prettenhoffer, I., 3937, 3938
Prickett, T. A., 1479
Prill, R. C., 991
Principi, P., 886
Prine, G. M., 2806
Promersberger, W. J., 3082
Pronin, A., 177
Proskuryakova, O. F., 3192
Protopapadakis, P., 1571, 1572
Protopopescu, V., 2997, 3165, 3237
Protsenko, A. K., 4427
Prott, H., 3193
Pruitt, W. O., 887
Prummel, B., 1951
Przesmycki, J., 888
Przestalski, S., 889, 890
Puffer, R. E., 1021
Pugavko, B. I., 4767
Pugh, W. J., 3333, 3697
Pulatov, U. I., 4357
Pulatov, U. Y., 4358
Puls, G., 3562
Purdue University Agricultural Extension Service, 299
Purnell, W. F., 3194
Puzyrev, V. Y., 4358
Pyatetskii, G. E., 2807, 4359
P'yavchenko, N., 4913
P'yavchenko, N. I., 891, 892, 2165, 5009, 5010
Qasem, A., 747
Qayyum, M. A., 2808
Quackenbush, T. H., 3939, 3940, 3941, 3942
Quinn, E., 3431, 4098, 4943
Quraishy, M. S., 2809

Rao, D. V. K., 3952
Rao, M. S. V. R., 301, 5036
Rao, N. S. G., 2169
Rao, V. S. R., 3952
Rabochev, I. S., 2166, 3943
Rachinskii, A. A., 2181, 3944
Rachinskii, V. V., 1597, 2167
Rafaelian, A. S., 3432, 3945
Rafaelyan, A. S., 3946
Ragar, S. R., 1102
Ragazzi, G., 3947, 3948, 4360, 4693
Raju, K. G. R., 1272
Raju, K. V., 3952
Raju, V. S., 3949
Ramadoss, C., 2642
Ramirex, A. R., 300
Rampilova, M. A., 3950
Ramsauer, B., 3433
Ramser, E., 2168
Randolph, J. R., 909
Raney, F. C., 3728
Raney, W. A., 893, 1066, 3951
Rankov, V., 2810
Ranwell, D. C., 894
Rapp, E., 2170, 3953
Rasis, M. De, 2171
Rasmussen, W. W., 895
Rasmusson, G., 2811
Ratledge, W. R., 3954
Ratner, R., 2624
Rattier, C., 3955, 4694
Raudkivi, A. J., 1412
Raudsepp, A., 1107
Rauser, W. E., 2812
Rauste, E., 2172
Rauzi, F., 896, 897
Rawlins, S. L., 2173
Raychaudhuri, S. P., 898, 899
Raymundo, M. E., 900
Razumov, G. A., 2174
Read, A. A., 1022
Read, D. W. L., 901
Rebuck, A. L., 2582
Reddi, G. H. S., 2813
Reddy, K. S., 2813
Redjoagung, S. F., 2895
Ree, W. O., 1294, 2175, 3195, 3196
Reed, D. E., 3956
Reed, J. E., 1413
Reed, L. W., 902
Reed, R. H., 5162
Reeder, S. W., 903
Reemann, J., 2814
Rees, D. M., 1612, 5072

Reeve, R. C., 369, 535, 904, 905, 906, 2051, 2159, 2217, 2815, 3069, 3642, 3662, 3736, 3957, 3958, 3959, 3960, 3961
Regamey, P., 4361
Rege, N. D., 2176
Reginato, R. J., 681, 907, 1101
Rego, Z. J. P. D. C. D., 2177
Regt, S. A. De, 4695
Reich, B. M., 1414
Reid, R. O., 2178
Reigner, I. C., 4362
Reineck, H. E., 908
Reinhart, K. G., 1415, 1416, 1417
Reiniger, P., 949
Reisenauer, A. E., 1570, 2179
Remorenko, V. V., 3962
Remson, I., 909, 2063, 2180
Renaud, U., 3963
Renfro, G. M., 3941, 3964
Rennie, D. A., 532
Repp, G. I., 2816
Reque, J. H., 3434
Resch, W. F., 2380, 3965
Reschke, K., 4465
Reshetkina, N. M., 2181
Resnicky, J. W., 495
Restuccia, G., 4696
Resulovic, H., 2817
Retvedt, K., 302
Reuss, J. O., 2818, 3966
Reyes, E. D., 910
Reynders, J. J., 911
Reynolds, H. R., 1571, 1572
Rhoades, E. D., 2570, 2819, 2820
Rhoades, H. F., 795, 953
Rice, L., 2071, 2072
Rice, R. C., 443, 1513, 1514, 1515, 1670
Rich, L. R., 912
Richard, F., 2182, 2821, 2822
Richards, B. D., 1418
Richards, L. A., 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 2823, 2824, 2825, 3967
Richards, P. L., 922
Richards, S. J., 923, 924, 925, 926
Richardson, E. V., 2244, 2245
Richart, F. E., 2188
Richason, B. F., 107, 927
Richey, C. B., 303
Rickenbach, R. G., 2910
Rid, H., 3435
Ridder, N. A. De, 1253, 1254
Ridiger, V. R., 3968
Riecken, F. F., 991
Riek, H. W., 4363
Rienks, A., 5163
Riga, 4364
Riga Latviiskii Nauchno-Issledovatel'skii Institut Gidrotekhniki I Melioratsii, 4914, 4915
Rigby, W., 3563
Rigg, G. B., 928
Rigot, G., 929
Riha, J., 3436
Rijtema, P. E., 2184
Riley, B. G., 1425
Ringoet, A., 930
Rios, A., 3969
Ripado, M. F. B., 931
Rippert, W. J., 2109
Risku, A., 4916
Ritchie, F. T., Jr., 563
Ritchie, R. T., 755
Rivers and Water Supply Commission, Victoria, Australia, 304
Rivoira, G., 932
Robel, R. J., 2826
Roberts, E., 3197, 4697
Roberts, J. T., 3198
Robertson, A. S., 663
Robertson, R. A., 4917
Robertson, V. C., 1001, 2259
Robins, J. S., 933, 2827, 3106, 3199
Robinson, A. R., 934, 935, 936, 1419, 1955, 1956, 4698
Robinson, C. W., 3603, 3604, 3970
Robinson, F. E., 937, 938
Robinson, G. K., 3200
Robinson, J. B. D., 939
Robles-Espinosa, J., 162
Rocha, M. S. D., 3201
Rochlitzer, J., 4365
Rode, A. A., 940, 941
Rodier, J., 2185
Rodionov, G. V., 4366
Roederer, P., 2522
Rof-Codina, J., 305
Roger, G., 4367
Rogers, A. J., 2388
Rognerud, B., 942
Rohwer, C., 934, 935, 936, 3559
Rollins, M. B., 2828, 3325, 3326, 4368, 4699, 4700, 4701
Romanenko, A. M., 3437
Romanov, V. V., 5011
Ronai, F., 4369
Ronchi, V., 4918
Ronkin, E. I., 2186
Roquero-De-Laburu, C., 4370
Roschanowski, D. J., 4371
Rose, C. W., 943
Rosenberg, N., 704
Rosenberg, N. J., 108
Rosenqvist, I. T., 944, 945
Ross, P. E., 3886, 3971
Rosser, J., 2187, 3202, 3203
Rossinski, K. I., 1220
Rossum, H. Van, 2188, 2189, 2190, 3551, 5164
Rowan, J. S., 3438
Rowe, P. B., 1420
Rowe, R. R., 1421
Royce, T. C., 1421
Royer, A. E., 3439
Rozanoff, A. N., 3972, 3973
Rozanov, A. N., 946
Rozenberga, V., 4702
Rozhdestvenskii, M., 3974
Rozin, V. A., 306, 3894
Ruber, E., 5073
Rubey, H., 3975
Rubin, J., 947, 948, 949
Rubin, P. R., 4930
Rubstov, D. M., 950
Rubtsov, V. G., 2829, 2830, 2831, 2832, 2833, 2834
Ruellan, A., 951
Ruiz-Castrejon, E., 3976
Ruiz-Santaella, J., 2835
Rumer, R. R., Jr., 1422
Rumyantsev, G. T., 2836
Rundle, V. A., 4703
Runge, E. C. A., 952
Runkel, S. T., 4662
Runkles, J. R., 980, 2233
Rusinov, I., 307
Rusinov, I. F., 109
Russel, M. B., 718, 954, 2576
Russell, E. J., 110
Russell, E. W., 308
Russell, G. C., 2628
Russell, J. S., 953, 3977
Russell, W. J., 2191
Rustamov, G. G., 3204, 3205, 3564
Rutledge, E. M., 666
Ruud, O., 2192
Ryan, T. M., 2600
Rybtsov, D. M., 955
Rzhanitsyn, N. A., 1423

Saakov, A. V., 4372
Sabo, E. D., 2165, 2193, 2837, 2838, 2839, 2840, 5012,5013
Sabol'ch, I., 956, 3978
Saborskii, O. V., 3558
Sadykov, G. K., 3565
Saidov, A. S., 2934
Sain, K., 4704
Sainani, R. H., 3595
Sainz-Ibarra, F., 3979
Saito, Y., 957
Sakaguchi, Y., 958
Sakai, T., 2194
Sakane, E. S., 3980
Sakhobiddinov, S. S., 959
Sakhonchik, V., 3206
Sakovich, A. E., 5014
Sakovich, F. I., 2841, 3440, 3441, 3442, 3443
Sakurai, J., 2195
Salamin, P., 2196, 3981
Salas, A. H., 4373
Saleem, M., 367
Salinger, J. P., 3444
Sålliskopet For Agronomiski Hydroteknik, 111
Salmela, J., 2388
Salmgren, O., 4374
Salmon De La Jara, P., 2197
Salter, P. J., 1155
Salvatore, M., 309, 2842

Samarov, V., 4115
Sambur, G. N., 3982
Samplon, S., 3627
Samuel, G. G., 112
Sanches, R. A. D. S., 3671
Sanchez, M. C., 595
Sandahl, K., 4705
Sanders, M., 310
Sanderson, R. A., 3566
Sandoval, F. M., 405, 805, 960, 961, 1212, 1213, 2843, 2844
Sandu, G., 850, 3983
Sannikov, G. P., 195, 3901, 4706
Santalin, K. V., 5015
Santing, G., 2198
Santovito, D., 5074
Sarasto, J., 962, 4862
Sarmah, K. C., 2845, 2846
Sartz, R. S., 963, 964
Sasaki, S., 3537
Sastry, S. K., 2847
Sato, S., 1424
Sato, T., 2681
Sato, Y., 793
Sattarov, D. T., 2865
Satterlund, D. R., 2848
Satyanarayana, P., 163
Savarenskii, A. D., 311, 312, 2199, 2200
Savaskan, C., 3663
Saveson, I. L., 965, 2201, 3207, 3208, 3209, 3210, 3211, 3212, 3213, 3214, 3215, 3216, 3243, 3984
Savitskii, L. M., 113, 5165
Savkin, V., 4707, 4708
Savonuzzi, M., 4709
Sawada, Y., 2750, 4852
Sayegh, A. H., 966
Sayre, W. W., 1310, 2202
Scarduzio, G., 313
Schaake, J. C., Jr., 1332
Schaefer, R., 2849
Schafer, G. M., 967
Schaller, F., 3217
Schaller, F. W., 1425, 2013
Scharff, E., 4919
Scharff, J. W., 5075
Scheer, H., 4710
Scheidegger, A. E., 968
Scheifele, M., 114
Schenck, H., Jr., 2203
Scherings, H., 4711, 4712
Schie, J. J. Van, 314, 2163, 2850, 2851, 3430, 4375
Schiechtl, H. M., 3218
Schiesswohl, D. P., 2355
Schiff, L., 402, 969
Schijf, J. B., 2204
Schimming, B. B., 2205
Schinke, H., 4713, 4714, 4715
Schirmer, 2852
Schirmer, M., 2206, 4376
Schlaudt, E. A., 2853, 5016
Schleifer, H., 970, 3336
Schleusener, R. A., 1426, 1968, 2207
Schlunsen, D., 4377
Schlunsen, H., 4378
Schmeidl, H., 4920
Schmid, A. A., 17, 115, 116
Schmid, P., 2208
Schmidt, 4379, 4380, 4381
Schmidt, H., 315
Schmidt-Ries, H., 971
Schmitt, 2209, 2210
Schmitt, W., 4715
Scholberg, P., 4382
Scholz, A., 2211, 3445, 3446, 4921
Schonberg, W., 2212
Schoonover, W. R., 972
Schrader, T. A., 5076
Schreiber, H. A., 712
Schulz, H., 117
Schulz, R. K., 393, 2442
Schulz-Falkenhain, H., 3985
Schumaker, G., 3970, 5047, 5048
Schumaker, G. A., 3698
Schulte-Karring, H., 316
Schulte-Wulwer, 1427
Schultz, J. D., 973
Schumm, S. A., 974
Schwab, E. O., 4603
Schwab, G. A., 2854
Schwab, G. O., 317, 975, 1293, 1308, 1534, 1777, 1854, 1901, 2213-19, 2430, 3346, 3447, 4167, 4383, 4384
Schwartz, G. M., 2220
Schwendinger, E., 2221
Scott, D. F., 2222, 2855, 3567, 4385
Scott, E. J., 2223, 2224
Scott, H. A., 1428
Scott, J. F., 3448, 4386
Scott, P. A., 3986
Scott, R. S., 2856, 2857
Scott, V. H., 1429, 1598, 2052, 3546, 3547, 4387, 4513, 4648, 4649, 4716, 4717, 4718, 4719, 4720
Seabloom, R. W., 2897
Seaman, D. E., 2270, 2271, 4721, 4794
Sebbel, H., 2858
Sedov, I. V., 4388
Seed, H. B., 1573
Seekamp, J. V., 4334
Segeberg, H., 4830
Segeren, W. A., 1991
Seggern, M. E. Von, 3987
Seginer, I., 976
Sehgal, J. L., 698, 2664
Sehgal, S. R., 2332
Seino, T., 2225, 2226
Sekiya, S. I., 2640
Selby, W. E., 4722
Selim, M. A., 1430
Selleck, R. E., 1793
Sel'Skokhoziaistvennye, 4389
Semenenko, A. N., 1431
Semenov, E. I., 977
Semenov, K. S., 2227
Sen, S., 2228, 2229
Seo, H., 673
Seoane, C. E., 318
Sepp, M., 2230, 4723
Seppala, N., 3449
Sequera-Tamayo, P. E., 3988
Sereda, P. J., 741
Sergeev, A. I., 4434
Sergutin, V. E., 4390
Serikov, I. M., 3219, 4254
Serikov, Y. M., 4391
Servello, V., 2859
Setala, S., 4392
Sewell, J. I., 1432, 2231,3220
Shaeffer, J. H., 5077
Shah, B. H., 3678
Shah, R. K., 978
Shah, S. L., 4470
Shahien, M. M., 1430
Shahroody, A. M., 3568
Shalhevet, J., 2860, 2861, 3450
Shallock, D. A., 4724
Shambaugh, G., 2430
Shamrai, L. N., 4611
Shanmugham, C. R., 825
Shannon, W. G., 1493
Shapiro, R. E., 2862, 2863, 2864
Sharma, R. G., 979
Sharma, V. D., 898, 899
Sharov, I. A., 319
Sharp, A. L., 1192, 1289, 1433, 1434
Sharpe, M., 3451
Shaumian, V. A., 184, 2232
Shaumyan, V. A., 4393
Shavrgygin, P. I., 2865
Shaw, E., 3384
Shaw, R. H., 980, 2233
Shaw, S. H., 3704
Shaw, S. P., 5078, 5079
Shaw, W. B., 981
Shchipakin, V. P., 2234, 2235
Shchitnikov, P. I., 4922
Shea, P. F., 982
Shea, P. H., 1574
Shearer, M. N., 3221, 3452, 3453, 3622, 4725
Sheerar, L. L., 1435
Sheiko, E. P., 4248
Shelestov, Y. V., 4935
Shell, E. W., 4726
Sheludiak, N. I., 320
Shelukhin, N. V., 2866
Shen, R. T., 4727, 4728, 4729, 4730, 4731, 4732, 4733
Sheng, T., 3222
Sheppel', P. A., 3223
Sheptitskii, B. A., 4394
Sherstoboev, N. Y., 3454, 3455
Sherwood, F. G., 4734
Shevelev, Y. Z., 3391, 3989
Shiflet, T. N., 2867
Shiga, Y., 983
Shikata, S. I., 380
Shileika, V. I., 3224, 3456
Shimada, Y., 677

Shimauchi, M., 2868
Shimazaki, F., 701
Shimomura, K., 814
Shimose, N., 984, 1176, 2984
Shin, V. C., 118
Shin, Y. H., 985
Shina, K., 2680
Shinozuka, S., 2609
Shiojima, M., 1042, 1043, 1044
Shipley, H., 4735
Shiraishi, H., 1549
Shiratori, K., 2869, 2979
Shishkov, K. N., 986, 987, 1200, 1261, 2870, 2871
Shishov, L. L., 875, 2871
Shiue, J. J., 3990
Shkinkis, T., 2236
Shkinkis, T. N., 2872, 2873, 3457
Shoji, F., 3458, 3459
Shoji, S., 2750
Shrader, W. D., 407, 2452, 2453
Shrag, V. I., 4736
Shreider, V., 3460
Shreider, V. A., 3280
Shtepa, B. G., 4395
Shubeck, F. E., 3390
Shubladze, K., 4737
Shubladze, K. K., 321
Shull, H., 988, 989, 2237, 4396
Shults, J. D., 3225
Shumakov, B. A., 2238
Shuravilin, A. V., 2643, 4923
Sieben, W. H., 2239, 2874, 3488
Sigaev, E., 1184
Silberman, E., 2275
Siline-Bektchourine, A. I.,1436
Silkin, A. M., 4397
Silva, A. A., 990
Silva, A. A. D., 611
Silveira, S. M., 5080
Silvester, R., 2240
Simmons, O. E., 4738
Simmons, W. P., 2241
Simon, A. L., 2242
Simonneau, P., 3991
Simons, D. B., 2243, 2244, 2245
Simons, J. P. J., 119
Simonson, G. H., 991
Sims, J. R., 2875
Sinha, B. K., 2423
Sinclair, J. D., 992
Sine, L., 2246, 2247, 2248, 2876, 3461, 4398
Singh, A., 521
Singh, G., 1468, 2333
Singh, K. P., 1437
Singh, R., 1468, 2760
Singlachar, M. A., 3058
Sisson, D. R., 2249, 3226, 3227, 3228, 3229, 3462, 3463, 3464, 4399
Sitnikov, A. M., 3230
Sitnikov, N. V., 406
Sittner, W. T., 2250
Skanker, H., 2761
Skempton, A. W., 1506
Skiliarov, G. A., 993
Skinner, M. M., 4525, 4526
Skochinskaya, N. N., 2952
Skodshoj, H., 4924, 5166
Skoric, A., 3465
Skoropanov, S. G., 322, 2251, 2252, 2877, 4925
Skosyreva, K. N., 3992
Skotnikov, V., 4400
Skov, K. S., 323, 2878, 2879, 3466, 3467, 4401
Skovborg, H., 324, 4739
Skrynnikova, I. N., 994, 995, 4899, 4926
Skurtul, A., 996
Slater, C. S., 3027, 3028
Slavanyi, Y. A., 997
Slee, J. E., 2253
Sleiy, M. V., 325
Slepoi, I. S., 4402
Sloan, D. E., 1438
Sloane, L. W., 965
Slob, W., 4740
Slojewski, R., 326
Sluis, W. T., 2254
Smedegaard-Mortensen, J.,5167
Smerdon, E. T., 998, 2255, 2256
Smet, L. A. H. De, 999
Smiles, D. E., 1000
Smirnov, A. V., 1439, 4403, 4741, 4742
Smirnov, T. E., 4927
Smit, A., 4743
Smit, J. A. P., 4744
Smit, W. B. D. V., 781, 784
Smith, C. E., 1440
Smith, C. N., 4745
Smith, D. A., 5081, 5082
Smith, D. D., 3231, 4404, 4746
Smith, E. A. L., 2257
Smith, F. D., 3468
Smith, G., 1441
Smith, G. E., 2593
Smith, G. L., 1426
Smith, G. S., 1442
Smith, H. W., 3764
Smith, J. B., 3993
Smith, J. H., 2880
Smith, K. J., 3232
Smith, L. W., 5083
Smith, M. W., 5084
Smith, O. E., 2258, 2561
Smith, R., 1001, 2259, 2881
Smith, R. F., 4928
Smith, R. L., 60, 120
Smith, R. M., 2260, 3233
Smith, S. C., 121
Smith, S. T., 750, 1002, 3994
Smith-Hurd Illinois Annotated Statutes, 122
Smits, H., 1003, 1004, 5099, 5168
Smoliak, L. P., 2882, 2883
Smolyak, L. P., 5017
Smrha, R. V., 60
Snegirev, I. A., 1005
Snell, A. W., 1006, 3578
Sniadowski, Z., 4339
Snijders, J. H., 327
Snodgrass, G. F., 2261
Snyder, D. E., 3755
Snyder, F. F., 1443
Soane, B. D., 1007, 1008
Sobolev, S. S., 5024
Soden, R. W., 2262
Soet, F. De, 328, 329, 4356, 5169
Soil and Water Conservation Research Division, 1444, 1445, 1575, 3995, 3996
Sokol'skaya, V. V., 4677
Sokolovski, V. V., 1576
Solarski, H., 123
Solli, S., 5018
Solomentsev, N. A., 1230
Soltesz, J., 330
Someren, C. L. Van, 1664, 2263, 4405
Someren, Van, 4406
Sommerkamp, 2884
Sondern, J. A., 4407, 4408
Sonneveld, F., 1009
Sor, K., 1010
Sorokin, M., 3469
Sorteberg, A., 2885
Soto, Y., 791, 792
Southeastern Water Law Conference University of Georgia, 124
Souza, H. B. De, 331
Sowers, G. B., 1577
Sowers, G. F., 1577
Sozykin, N. F., 2886, 5019
Spain, J. M., 3470
Spangler, M. G., 1578
Sparrow, G. N., 3234
Speir, W. H., 1011, 2365, 3760
Spencer, G. W., 4409, 4410,4507
Spencer, J. R., 2159, 3669,3758
Spencer, R. T., 2264
Spencer, W. F., 3342, 3343, 3471
Spengler, V. U., 3620
Spier, W. H., 1882
Spiridonov, Y. Y., 2743
Springer, M. E., 758
Sprout, P. N., 497
Spurling, M. B., 3997
Spurrier, E. C., 3235
Sribyni, M. F., 1446
Sriramamurthy, G., 3998
Srivastava, P. B. L., 3999
Staff, C. E., 4155, 4411
Stafford, I. B., 1447
Staff Writer, 1448, 3236, 4929
Stahle, E., 5170
Stakhnevich, V. L., 1012
Stallings, J. H., 332, 333
Stamp, L. D., 2265
Stancu, T., 3237
Stanculescu, A., 3119
Stanhill, G., 1155
Stanislawski, D., 3238
Stankevich, V. S., 266, 2266, 4930
Stanley, L. A., 125
Staple, W. J., 617
Starikov, K. N., 2267
Staveren, J. M. Van, 334, 558, 2268, 2269

Steegeman, A. G. J., 2034
Stefanenko, V. V., 4016
Stefanov, I. A., 4412
Steffanoni, L., 4413
Stegman, E. C., 4581
Stein, M., 2887
Steinhardt, R., 947, 948, 949
Stelling, P., 5171
Stepanov, L. N., 1013
Stephens, J. C., 2270, 2271, 2888, 2889, 4931
Stephens, R. M., 3239, 3240
Steppler, H. A., 399
Ster, A., 335
Sterling, T., 5085
Sternberg, I., 2272
Stetson, E. D., 1646, 1647
Stewart, B. A., 557
Stewart, E. H., 1014, 1882
Stewart, F. B., 2733, 2734, 2890
Stewart, G. G., 2891
Stewart, G. L. R., 1015
Stewart, G. S., 1016
Stewart, K. V., 3241
Stewart, K. V., Jr., 3242, 3243
Stinga, N., 2892
Stockinger, K. R., 535, 796
Stoeckeler, J. H., 4414, 5020
Stokes, C. M., 3052
Stokstad, O., 1017
Stol, P. T., 1449
Stolzy, L. H., 1018, 1019, 1020, 1021, 1127, 1520
Stone, J. F., 1022
Stoneman, T. C., 4000, 4001
Story, C. G., 4415
Strach, Z., 509
Strahilov, E., 4788
Strain, R. J., 3472
Stranski, K. I., 3244
Straub, L. G., 2273, 2274, 2275
Street, R. L., 2364
Streeter, V. L., 4416
Strijbosch, T., 1023
Strogonov, B. P., 728
Strom, H. G., 1450
Stromberg, L. K., 2893
Strong, D. C., 126
Struchtemeyer, R. A., 1024
Struckman, H. J., 4747
Struyk, W., 296
Stryjewski, F., 2276, 4748
Stubbs, J., 5021
Studholme, A. T., 5085
Stùdii de hidroamelioratii, 336
Suber, E., 2822
Sudhoff, H., 4749
Sudo, S., 1025
Sugden, L. G., 5041
Suggs, D. D., 4750
Suladze, I. D., 4751
Sultanov, Y. G., 2894
Sumarjono, M., 2895
Sun, C. K., 2277
Sun, R., 5172
Sung, Y. H., 1177
Supino, G., 4002
Sutton, H. P., 1451
Sutton, J., 1758
Sutton, J. G., 127, 337, 338, 1026, 2278, 2896, 3473, 3474, 3569, 3570, 4752
Sutton, J. H., 4003
Suzuki, S., 1027
Suzuki, T., 1025, 1027
Sviklis, P. B., 339
Svinarev, V. I., 1028
Svirin, V. I., 4932
Swan, B., 4004
Swanson, N. P., 3117, 3971
Swanson, R. W., 1103
Swartzendruber, D., 1029, 1030, 1031, 1032, 2279, 2280, 2281, 2282, 2283, 2284
Sweet, C. L., 4005, 4753
Sweet, R. L., 1915
Swenson, E. A., Jr., 5086
Swift, A., 340, 3475, 4417, 4418, 4754
Sylvester, R. O., 2897
Symposium, 3245
Sys, C., 341
Szabolcs, I., 1033, 1034, 3695, 4006, 4007, 4008, 4009
Szabon, J., 4419
Sziki, G., 4010
Szkolnicka-Roszyk, S., 1036,1037
Szilagyi, G., 1579
Szilvassy, Z., 1035
Szuniewicz, J., 2770, 4011
Szuszkiewicz, T. E., 1019

Tabois, H. G., 2285
Tabor, C. C., 4012
Tabuchi, T., 1162, 1163, 1164, 2399
Taeger, H., 4622
Taira, K., 1383
Taipei, China Hydraulic Laboratory, 2286
Tajino, N., 3476, 3477
Takagi, M., 1038, 1039
Takagi, S., 2287, 2288, 2289, 2290
Takahashi, H., 4549
Takahashi, K., 3246
Takai, Y., 1040
Takenaka, H., 1041, 2399, 2680
Takes, C. A. P., 5173
Takijima, Y., 1042, 1043, 1044, 2898, 2899, 2900, 2901, 2902
Takusuka, T., 1049
Talbert, R. E., 5087
Talsma, T., 1045, 1046, 1047, 1048, 2291, 2292, 3478
Talts, A., 2293
Talureau, R., 4933
Tamai, T., 1049
Tamboli, P. M., 1050
Tamhane, V., 2176
Tanabe, H., 3169
Tanabe, T., 4549
Tanaka, A., 4872
Tanaka, I., 2903
Tanaka, K., 2294, 2295
T'ang, S. Y., 4013
Tanis, K., 4420, 4421
Tanji, K. K., 1767
Tanner, C. B., 1145
Tanttu, A., 5022
T'ao, K. T., 1051
Tarumi, H., 4614
Task Force, 2296
Tateoka, R., 2904, 2905
Taylor, G. S., 1052, 1111, 1695, 1831, 2219, 2297, 2298, 2299, 2300, 2301, 2302, 2308, 2348, 2349, 2906, 3247
Taylor, H. M., 1053, 3360
Taylor, R. E., 3111
Taylor, S. A., 1016, 1054, 1055a, 1055b, 1056, 1057, 1058, 1059, 1144
Taylor, W., 5053
Tedrow, J. C. F., 2493
Teimurov, K. G., 3597, 4014, 4015
Teipel, R., 2303, 2907,4422, 4423, 4755, 4756, 4757, 4758
Temnyi, M. T., 4016
Tenny, M. K., 128
Terasawa, S., 1060, 1061, 1062
Terenzio, U., 4682
Terra, G. J. A., 1452, 4017
Terrell, P. W., 2304
Teseling, H. J., 4424
Textor, H., 129
Thames, J. L., 1063, 2305, 4425
Thaxton, E. I., Jr., 998
Thenabadu, M. W., 2908
Theobald, G. H., 2306, 2307, 4759
Theron, J. J., 1064
Thiel, T. J., 1065, 2218, 2219, 2301, 2308, 2349
Thomas, F. H., 2909, 3760
Thomas, H. E., 130
Thomas, J., 342
Thomas, J. R., 2623
Thomas, R. O., 131, 132
Thomaser, F., 3479
Thompson, D., 133
Thompson, L. F., 2594
Thompson, J. C., 1453
Thompson, K., 4934
Thomsen, K., 4760
Thomte, D., 134
Thorfinnson, S. T., 1580
Thorn, R. B., 2309
Thorne, D. W., 4018
Thorne, J. P., 2910
Thorne, M. D., 893, 1066, 3942
Thornton, J. F., 684, 685, 1067, 3040, 4597, 4598
Thurmann-Moe, P., 2911
Till, M. R., 1068, 1069, 1070, 1071

Timmons, F. L., 4761, 4762
Timmons, J. F., 135
Timofeev, A. F., 2799, 2912 3776, 4763
Tindall, E. E., 5043
Tipuri, V., 2913
Tishchenko, V. A., 1072
Tison, L. J., 1454
Titz, L., 3168
Tiulenev, N. A., 2914
T'Jonck, G., 3480
Todaro, U., 4682
Todd, D. K., 1455, 1564, 1581
Togo, S., 2310
Toksoz, S., 2311
Tokudome, S., 695, 696, 697, 4880
Tokyo University College Agriculture Laboratory, Agriculture Economy, 2915
Tolchkov, S. M., 4426
Tolman, N., 4764
Tolpa, S., 1073
Tomashevskii, I. I., 1074
Tomberg, U. K., 2312
Tomlinson, G. E., 5174
Tomomune, T., 2313
Tonini, G., 2916
Toogood, J. A., 789, 3752
Toohey, C. L., 4415, 4765
Topchiev, E. A., 4427
Toratani, H., 703
Torell, P. J., 2591
Toro, H., 4019
Torre, G., 2314, 2315, 2316
Torrecabrera, J., 343, 4020
Torres, C. D. F., 2317
Toscano-Romero, E., 1615
Toshakov, A. D., 344
Tossett, O., 5088
Toth, J., 1456
Touwen, L., 2917, 3248
Tovey, R., 1075, 1650, 2918, 2919, 2920
Towner, G. D., 2403
Townsend, L. R., 2921
Tramdahs, A., 4766
Trappel, A., 2922
Traulsen, H., 345
Trelease, F. J., 2318
Trevijano, S., 2319
Trevijano-Nolina, S., 2923
Trickett, E. S., 883
Triplett, G. B., 2924
Triplett, G. B., Jr., 2938
Trist, P. J. O., 1076
Trivedi, A. M., 978
Trizno, S. I., 2925
Troeh, F. R., 2320
Tron, M., 346
Trueba-Gomez, A., 3976
Truss, P. S., 2926
Truu, A., 1107
Trzebinska, M., 3481
Ts'ai, W. K., 575
Tsarevskii, A. M., 4767
Tsekhanovich, P. V., 4428
Tseng, R. H., 4768
Tsinis, E. A., 2321
Tsonev, I., 2322
Tsu, W. C., 482
Tsukanova, A. I., 4021, 4022
Tsukamoto, Y., 2777
Tsunematsu, S., 3249
Tsutsui, H., 4023, 4024
Tsya, D. L., 1626
Tszya, D. L., 2167
Tucek, V., 2323
Tucker, D. E., 4429
Tuinstra, U., 4769
Tuinzing, W. D. J., 5175
Tukamoto, Y., 1457
Tung, C. P., 1123, 4058
Turbin, V. N., 2324, 3482, 3483, 3484
Turc, L., 1077
Turetskii, R., 4430
Turetskii, R. L., 4310, 4431, 4432
Turkey Directorate General of State Hydraulic Works, 2325
Turks, V. A., 4770
Turnbull, W. J., 1582, 1583, 1584, 4771, 4772
Turner, K. G., 661
Turney, J. R., 136
Turowski, A., 2326
Tuttle, J., 1458
Tuttle, R. E., 3485
Twersky, M., 1078
Tyra, T. D., 2349
Tyson, H. N., Jr., 1459
Tyulenev, N. A., 4935

Ubell, K., 1079
Ubing, W. S., 2927
Uchiyama, N., 1080, 1081, 2928
Ugolini, F. C., 2493
Uhden, O., 347, 4936
Uhlig, H. G., 1460
Uiska, I., 3295
Uiska, Y., 2929
Ukolov, I. A., 3926
Ullah, W., 2327
Umarov, E., 4025
Umback, C. R., 1797, 2930
Umeda, Y., 1835, 4854
Unceanschi, L., 3907
Underwood, N., 1102, 1103
Unger, J. L., 2328
United Nations, Educational, Scientific and Cultural Organization, 4026
U.S. Agricultural Research Service, 1082, 2931, 4773, 4774, 4775
U.S. Bureau of the Census, 137
U.S. Bureau of Reclamation, 1461, 4776
U.S. Commission on Intergovernmental Relations, 138
U.S. Farmers Home Administration, 139
U.S. Forest Service, 1083
U.S. Geological Survey, 1462
U.S. Inter-Agency Committee on Water Resources, 1463
U.S. Inter-Agency Committee on Water Resources Subcommittees on Hydrology and Sedimentation, 1464
U.S. International Cooperation Administration Operations Mission to the Somali Republic, 4027
U.S. Regional Salinity Laboratory, Riverside, California, 2932
U.S. Soil Conservation Service, 1084, 1465, 1466, 2329, 2330, 2331, 4028, 4777
U.S. Soil Conservation Service, Engineering Division, 3571
U.S. Soil Conservation Service Engineering and Watershed Planning Unit, 3572, 3573
U.S. Tennessee Valley Authority, 1467
Uotila, P. J., 3250, 4433, 4478
Uppal, H. L., 1468, 2176, 2332, 2333, 4029
Urban, J. B., 772
Urena, R. D., 4779
Urman, I., 2334
Ursic, S. J., 2305
Usmanov, A., 1262
Usov, A. S., 4780
Uspenskii, V. P., 4434
Ussery, L. R., 2109, 4030
Uttar Pradesh Information Department, 2933
Uttar Pradesh Irrigation Research Institute, 2335

Vadgaard, K., 5176
Vadyunina, A. F., 4031
Vagas, I., 1579
Vagin, A. T., 4435
Vaigneur, H. O., 3486
Vaksman, E. G., 2934
Valantine, V. E., 1469
Valbuena, F. L., 3593
Valeanu, L., 3251
Valencia, I. G., 567
Valiron, F., 4781
Valk, G. G. M. Van Der, 2935
Valk, H., 1085
Valk, U., 1085, 4937
Valken, K. F., 1470, 5177
Valle Florencia, H. Del., 1086
Vallentine, H. R., 2336
Vana, J., 4436
Van Arsdall, H. E., 4032
Van Asbeck, W. F., 4782
Van Auken, E., 4033
Van Bavel, C. H. M., 681, 826, 907, 1087-1099, 1100-1103, 1382, 1657
Van Buren, W., 631
Van Der Elst, F. C. C. H., 2936
Van Der Merwe, A. J., 3252
Van Dersal, W. R., 2220
Vandertulip, J. J., 1585
Van Der Westhuizen, M., 1104
Van Doren, C. A., 3127

Van Doren, C. E., 3106
Van Doren, D. M., 2924,2937,2938
Van Everdingen, R. O., 2337
Vania, J., 4437
Vannote, R. L., 4783
Van Rozenboom, G., 4793
Van Schaik, J. C., 2338, 4034
Van Schilfgaarde, J., 348, 1006, 1432, 1671, 1778, 2231, 2340, 2341, 2342, 2343, 2344, 3323
Van Schalkwyk, C. J., 2339
Van Straaten, N. J., 4438, 4784
Van't Woudt, B. D., 1105, 2940, 4439
Vanzetti, C., 140, 1471
Vapaev, M., 4035
Varadarajulu, G. H., 373
Varday, Gy, 4440
Vardzelashvili, M. G., 4785
Varennes E Mendonca, P. De, 1472
Varuntsian, E. S., 2345, 4036
Varuntsyan, E. S., 4037, 4038, 4039
Vasil'chenko, A. V., 4040
Vasil'eva, E. I., 2496
Vasil'eva, I. A., 4041
Vasudev, S. R., 4042
Vatnebryhn, A., 4441
Vazquez, A., 3627
Veber, K., 1106, 1107
Vedenyapin, V. V., 4786
Veelen, W. I. C. Van, 4938
Veen, E. T., 4787
Veen, J. Van, 349, 350
Veihmeyer, F. J., 1108
Veldman, E. C., 2112
Velev, D., 4043, 4788
Velichko, E., 4044
Velicu, L., 3574
Veliev, M. I., 4045, 4046
Veltkamp, G. W., 1586
Velychko, M. F., 3487
Venezia, F., 5074
Venkataraman, A. R., 5025
Venstra, A. J., 5168
Verdejo, G., 3863
Verhoeven, B., 3488
Verhoeven, I. B., 4047
Verkoren, J., 4939
Verme, L. D., 1473
Vermeiren, L., 2248
Verner, A., 4940
Verner, A. R., 4941
Vernisse, J., 1474
Versteeg, W., 2917, 3248
Vethe, K., 4442
Vetterlein, E., 1109
Vicente-Orozco, J., 5178
Vidal, H., 2941, 2942, 2943, 4443
Videira-E-Castro, A., 4048
Vidmantas, I. P., 1110
Viets, F. G., Jr., 2346, 2586
Viilberg, K. K., 2944
Vilenskii, D. G., 351
Vimoke, B. S., 2301, 2347, 2348, 2349
Vimoke, S., 1111
Vinogradov, V. G., 1183
Vishnevskii, V. P., 3253
Visser, W. C., 352, 1112, 1113, 1114, 2350, 2351, 4049
Viste, K. L., 4648, 4649
Vladimirov, A. G., 4050, 4051
Vladychenskii, S. A., 353, 1475
Vlasin, R. D., 104
Vlugter, H., 2352, 4052
Vogel, H. D., 1476
Vogel, P. De, 272
Vogios, K., 3598
Voigt, E., 141
Voinis, N., 4444
Voisey, P. W., 1115
Volejnik, M., 354
Volik, V., 2945
Volik, V. F., 2946
Volker, A., 1477, 5179, 5180
Volkov, I. A., 3924
Volkov, R. I., 3575
Volkova, N., 2130
Volkovskii, P. A., 1478, 2947, 4053, 4789
Volobuyev, V. R., 2948
Volobuev, V. R., 2353
Voltz, C. W., 4445
Volynov, A. M., 4054
Vomperskii, S. E., 1116, 2949, 2950, 2951
Voorhees, W. B., 663
Vora, J. C., 978
Vovchenko, I. T., 5181
Voznyuk, S. T., 2952
Vries, J. D., 1117
Vuento, P., 4942
Vyzgo, M. S., 2354

Wack, B., 1118
Wadleigh, C. H., 1119, 2953
Waffenschmidt, D., 3254
Wagner, G. H., 1120
Wagner, V. J., 4446
Wagoner, H. E., 4447
Wagret, P., 355
Wahhab, A., 2607
Wait, J., 1644, 1880
Wakefield, J. W., 2355
Waki, K., 2666
Wakui, M., 3458, 3459
Waldis, L., 1121
Walker, C. R., 5089
Walker, C. W., 4055
Walker, G. D., 1585
Walker, L. C., 2954, 2955, 2956
Walker, P., 1122, 2356, 3255, 3256
Walker, W. H., 3576
Walkowiak, H., 4790
Wallack, B., 3489
Wallbrink, J. C., 3257
Wallis, J. R., 5023
Wallis, W. T., 142, 143
Wallo, M., 2180
Walsh, T., 4943
Walter, R. J., 4448
Walton, W. C., 1479, 3576
Wang, A. C., 4063
Wang, C. C., 2957
Wang, F. C., 2357
Wang, F. F. C. C., 2358
Wang, K. H., 575
Wang, S. C., 4056
Wang, T. C., 1123, 4057, 4058
Wantanabe, K., 2361
Wantland, D., 1353
Ward, A. D., 1447
Ward, R. C., 1480
Ware, M., 248
Warne, W. E., 5182
Warnick, C. C., 1124
Warrior, S. K., 1125
Wartena, L., 144, 2285, 2359, 2387
Was, S., 1126
Wasley, R. J., 2360
Watanabe, H., 4791
Watanabe, I., 4792
Watanabe, K., 1587, 2958
Water Committee, 1481
Water Conservancy Research Institute of Shansi, 4059
Watson, C. E., 4703
Watson, J. E., 1838, 3258
Watson, K. K., 2362, 2363
Watson, W. O., 3755
Watters, G. Z., 2364
Watts, D. G., 2959, 3490
Wavrin, W. D., 4060
Weaver, H. A., 2365, 2603
Weaver, M. M., 145, 146, 147
Webber, E. E., 1249a
Weber, E. M., 1459
Webster, A., 3836, 4061
Webster, M. J., 2366
Weckstem, P., 2960
Weeks, L. O., 2159, 4062
Weeks, L. V., 926, 1127
Wegmayr, G., 3491
Weij, H. G. Van Der, 4793
Weinitschke, H., 356
Weinkauff, H. C. C., 1482, 1483
Weiss, W., 3124
Weissenborn, K., 1128, 5183
Weldon, L. W., 2270, 2271, 4761, 4794
Welker, C. H., 3577
Weller, M. W., 5090
Wellisch, H., 1588
Wen, H. J., 148
Wen, N. J., 4063
Werff, H. J., Van Der, 357
Werminghausen, B., 4449, 4450
Werenfels, L., 3399, 3547
Werner, P. W., 1484
Wertheimer, M., 358
Wertz, G., 1129, 2367
Wesseling, J., 1130, 2368, 2369, 2370-2377, 4451
West, B., 4064
West, S. H., 2806
Westerhof, J. J., 359, 1131, 1264, 4065

Western Australia Department of Agriculture, Soils Division, 3259
Western Crops & Farms Management, 3260
Wheaton, R. Z., 3492, 4516
Whelchel, H. C., 2378
Whimster, G. S., 3493
Whisler, F. D., 1657
Whitaker, G. H., 4452
White, A. H., 4066
White, E. M., 1132, 1133, 1485
White, G. F., 1486
White, H. C., 4453
White, L. G., 4524
Whitman, W. C., 3047
Whitney, R. S., 3662, 3736
Whitten, G. R., 5091
Whittig, L. D., 1134-1136
Wickline, E. V., 4795
Wiebe, H. H., 2816
Wiebe, J., 4454
Wiebing, R., 4944
Wiedemann, W., 4796
Wiegand, C. L., 746, 2511
Wieringa, K. T., 1137
Wiersma, F., 1797, 2930
Wiese, J., 4797
Wiggers, A. J., 725, 1004
Wijk, A., Van, 4798-4805
Wijk, W. R. Van, 839, 1487, 2377
Wiklander, L., 2961, 2962
Wilcox, J. C., 1138-1141, 2379, 2685, 2963
Wilcox, L., 3961
Wilcox, L. V., 1142, 2380, 2953, 2964, 2965, 2966, 2967, 4069, 4070
Wilde, S. A., 500
Wilder, C. L., 4806
Wilder, C. R., 4455-4457, 4807
Wilding, L. P., 579, 581, 1143
Wilkes, W., 1644
Wilkie, D. R., 3261
Willardson, L. S., 1144, 2968, 2969, 4071, 4072
Willet, J. R., 2112, 2381, 2382
Willets, D. B., 2970
Willey, C. R., 1145, 2975
Williams, D. A., 1488, 2383, 5184
Williams, E. G., 2971
Williams, G. G., 563
Williams, H. R., 1489
Williams, R. E., 4945
Williams, S. G., 2972, 3494
Williams, T. T., 4808
Williamson, E. J., 1797
Williamson, R. E., 1146, 2344, 2973, 2974, 2975
Willits, N. A., 458
Willrich, T., 3217
Willrich, T. L., 3262
Willson, R. J., 4809-4812
Wilson, B. W., 2178
Wilson, C. L., 1174
Wilson, C. S., 5092
Wilson, E., 2430
Wilson, J. N., 1490
Wilson, L., 4073
Wilson, L. G., 4074
Wilson, N. W., 1491
Wilson, R., 4813
Wilson, R. G., 4075
Wilson, T. V., 3578
Wiltshire, G. R., 3263
Wimberly, J., 3264
Wimberly, J. E., 2384
Wind, G. P., 1148, 2385, 4944
Wind, R., 1149
Wineland, J. A., 4814
Winger, R. J., 1150, 1763
Winger, R. J., Jr., 1151
Winter, E. J., 1152-1155
Winterkorn, H. F., ed., 1156
Wishart, R. L., 4458
Wisler, C. O., 1492
Wisman, O., 151
Wit, C. T. De, 2386, 2387
Witherington, C. G., 2388
Witherspoon, D. F., 4459
Wittmus, H. D., 3265
Wittsell, L. E., 656
Wohlenberg, E., 360
Wohlfarth, E., 2389
Wohni, E., 361
Wold, E., 4946
Wolf, W., 362
Wolman, A., 149
Woo, D. C., 2390, 2391
Wood, J. B., 3495
Wooding, R. A., 1886
Woodruff, C. B., Jr., 3266
Wooley, D. C., 1641
Wooten, H. H., 150
Work, R. A., 1493
Worley, L. D., 2392
Worrall, G. A., 4067
Worstell, R. V., 2053, 2054, 2302, 2393
Woudt, B. D. V., 4068
Wouters, 4815
Wrenn, E., 4076
Wright, G. A., 152
Wright, K. R., 2394, 2395
Wu, I-P., 1494
Wu, T. Y., 2957
Wyatt, R., 868

Xabregas, J., 1157

Yaalon, D. H., 1158, 1159
Yadav, J. S. P., 2716, 2976, 2977, 4077
Yajima, T., 2396
Yakovlev, B. I., 2397, 3496, 3776
Yakovlev, I. S., 1160
Yakubovich, L. V., 4460, 4963
Yamada, Y., 794
Yamaguchi, E., 1589-1596, 2398, 4816
Yamaguchi, H., 2978, 2979
Yamaguchi, I., 1495
Yamaguchi, M., 2771
Yamamoto, S., 1535, 1835, 4854
Yamamoto, T., 1161
Yamanaka, K., 820
Yamazaki, F., 1162-1164, 2399
Yamazaki, K., 1165
Yanatori, S., 2674, 2675, 2676
Yarovenko, V. V., 160, 1166
Yarushin, M. I., 290
Yarvela, K. A., 1167-1169
Yasinetskii, V. G., 4461
Yasutomi, R., 1025
Yawata, T., 1162-1164, 2399
Yefimov, V. N., 2980
Yegorov, V. V., 4078
Yeo, R. R., 2494, 4761
Yermanos, D. M., 2564, 2981
Yesilkoy, S., 1170
Yeutter, C., 153
Yevnin, A., 4817
Yi, H. Y., 1171
Yih, C. S., 1563
Ying, L., 1172
Ying, T., 4079
Yli-vakkuri, P., 2982
Yokota, R., 2400
Yoneda, S., 984, 1173-1176, 2983, 2984
Yoshida, T., 3249
Yoshino, M., 2985, 2986, 3805
Yoshioka, S., 1810
Youll, W. J., 4080
Young, G., 1496
Youngs, E. G., 1000, 1719, 1720, 1730, 2401-2403
Yu, C., 2957
Yu, H. M., 4081
Yu, W. W., 1177
Yuan, S. C., 4462
Yuan, T. W., 1178
Yuldashev, A., 1179, 4082
Yunevich, D. P., 2404, 3497, 4829
Yunik, S. M., 3982

Zabegailov, A., 5185, 5186
Zaborovskii, E. P., 5024
Zadunaiskii, I. N., 1012
Zaghloui, M. G. E. D., 1497
Zaidel'man, F. R., 1180-1183, 2405, 3498
Zaidman, I. D., 4494
Zaidman, Y. D., 4820
Zaitsev, A., 1184
Zaitsev, B. D., 2987
Zaitsev, V. B., 2406
Zakhidov, A., 4083
Zaks, V. G., 3498
Zaleski, M., 4818
Zamarin, E. A., 2407
Zamouril, J., 2988
Zander, J., 363
Zanker, K., 1687, 2408, 2409

Zanna, L., 4463
Zarva, V., 3714
Zarzycki, J., 4819
Zaslavskii, M. N., 3267, 3268
Zaslavsky, D., 1498, 2410
Zasukhin, S. V., 4084
Zavodnov, S. S., 4085
Zawadzki, S., 1185
Zdobnov, E. I., 2411, 2412
Zdravkov, K., 4464
Zee, C. H., 2413
Zeeuw, J. W. De, 154, 155, 2414, 2415
Zeitlen, J. G., 1548
Zeldam, O. T., 4465
Zentmyer, G. A., 2499, 2989
Zhdannikova, E. N., 2990
Zhdanova, E. I., 2991
Zheleznyakov, G. V., 2416
Zherebtsov, V. V., 4466, 4820
Zhilinskii, V. A., 4086
Zhukovetskii, P. A., 1499
Ziegenbalg, F., 4467
Ziemnicki, S., 3269
Zierold-Reyes, L., 4821
Zikri, B., 3719
Zimmermann, 2417
Zingg, A. W., 3107, 3108, 3270, 3271
Zinke, P. J., 1186
Ziulikov, G. M., 4468
Ziul'kov, G. I., 2925
Ziza, A., 2992
Zlatev, G., 1187
Zollner, E., 3579, 3580
Zonneveld, L. S., 1188
Zsoldos, L., 3272
Zubets, V. M., 364, 2418, 2993, 3499, 3500, 4947
Zuidberg, J. L., 3765
Zumberge, J. H., 2419
Zvonkov, V. V., 5123
Zwan, L. M. Van Der, 3389
Zwerman, P. J., 409, 444, 2420, 2860, 2861, 3501

SUBJECT INDEX
(Figures refer to Annotation Numbers)

Acid soils--2561, 3474, 4826, 4875.
Adding soil materials to mineral soils--1980, 2034, 2417, 2869, 3222, 3248, 3887.
Adding soil material to peat soils--1731, 2868, 2869, 2927, 3330, 4850-4852, 4871, 4872, 4880, 4896, 4909, 4912, 4934, 4984.
Adding soil material to saline and sodic soils--148, 1731, 3608, 3678, 3684, 3863, 3874.
Aerial photographs--981, 1389, 1680, 1728, 1749, 1751, 1862, 1992, 2109, 2272, 2293, 2811, 3819.
Afghanistan--590, 2065, 5155.
Africa--233, 253, 254, 269, 275, 288, 362, 395, 426, 430, 510, 553, 615, 736, 781, 784, 821, 871, 930, 931, 939, 951, 972, 1007, 1008, 1064, 1104, 1205, 1253, 1254, 1430, 1452, 1495, 1500, 1532, 1610, 1631, 1632, 1806, 1836, 1863, 1883, 2016, 2062, 2089, 2259, 2339, 2522, 2560, 3018, 3026, 3090, 3093, 3114, 3185, 3253, 3305, 3331, 3349, 3409, 3508, 3629, 3712, 3719, 3762, 3808, 3810, 3908, 3955, 3963, 3991, 4027, 4048, 4065, 4067, 4157, 4175, 4438, 4530, 4552, 4668, 4694, 4781, 4782, 4784, 4908.
Alabama--3051, 3163, 3743, 5147.
Alaska--2493.
Albania--5139.
Annotated bibliography--122, 197, 502, 503, 1414, 1462, 1463, 1464, 1731, 2523-2525, 3585, 3686-3688, 3819, 4837.
Arid regions--573, 1257, 1435, 1458, 1867, 2529, 2823, 3690, 3780, 3830.
Arizona--374, 912, 1327, 2494, 3685, 3858, 4251, 4538.
Arkansas--461, 666, 1274, 1489, 1644, 1704, 1879, 2491, 2494, 2602, 2665, 3097-3101, 3103, 3159, 3211-3213, 3741, 3742, 4125, 4453, 4572.
Armenia--3606, 3946.
Austria--1273, 1506, 1653, 1789, 2221, 3335, 3744, 4664.
Australia--189, 190, 388, 389, 411, 422, 488, 501, 592, 619, 658, 748, 750, 769, 776, 1002, 1045-1048, 1068-1071, 1255, 1450, 1680, 1801, 1838, 1872, 1907, 2014, 2040, 2187, 2264, 2291, 2292, 2471, 2557, 2649, 2972, 3003, 3009, 3016, 3132, 3149, 3150, 3172, 3173, 3200, 3202, 3203, 3232, 3239, 3240, 3257-3259, 3263, 3276, 3287, 3288, 3298, 3316, 3356, 3383, 3410, 3413, 3494, 3514, 3625, 3637, 3689, 3710, 3768, 3783, 3836, 3977, 3994, 3997, 4000, 4001, 4004, 4061, 4080, 4105, 4131, 4226, 4252, 4253, 4334, 4409, 4410, 4415, 4446, 4452, 4458, 4475, 4507, 4531, 4564, 4607, 4612, 4656, 4670, 4685, 4765, 5028, 5034.

Bedding--313, 748, 1611, 1777, 2258, 2331, 2378, 2452, 2470, 2543, 2678, 2784, 2978, 3081, 3085, 3183, 3210, 3229, 3234, 3243, 3323, 3788, 3863, 3932, 4399.
Belgium--193, 218, 341, 400, 471, 672, 819, 1344, 1837, 3480, 3533, 4103.
Bentonite--509, 701, 1527, 1529, 1553, 1568, 1575, 2039, 4368, 4471, 4475, 4496, 4502, 4521, 4522, 4550, 4559, 4603, 4611, 4614, 4632, 4643, 4647, 4699-4701, 4725, 4727-4733, 4776, 4797, 4809, 4812, 4817.
Bibliography--165, 196, 277, 348, 478, 518, 777, 928, 1204, 1467, 1506, 1588, 2296, 3996, 4489, 4646, 4847, 4864, 4887.
Biological weed control--1942, 2270, 2271, 4552, 4568, 4721, 4726, 4773.
British Isles--7, 33, 36, 45, 53, 86, 99, 102, 103, 152, 203, 221, 244, 273, 291, 304, 434, 526, 541, 612, 660, 661, 817, 894, 1076, 1125, 1152-1155, 1258, 1418, 1504, 1505, 1521, 1700, 1715-1720, 1730, 1772, 1815, 1824, 1899, 1926, 2019, 2154, 2262, 2306, 2307, 2309, 2362, 2401, 2447, 2497, 2520, 2537, 2605, 2608, 2613, 2716, 2719, 2800, 2891, 2971, 2976, 2977, 3216, 3290, 3317, 3327, 3328, 3351, 3359, 3401, 3406, 3420, 3431, 3468, 3472, 3493, 3563, 3899, 4098, 4101, 4113, 4114, 4139, 4153, 4170, 4208, 4288, 4289, 4383, 4429, 4570, 4697, 4834, 4841, 4860, 4874, 4917, 4924, 4928, 4934, 4943, 4971.
Bulgaria--11, 609, 621, 1187, 1618, 1983, 2090, 2091, 2322, 3179, 3189, 3244, 3867, 4043, 4264, 4266, 4464, 4500, 4788.

Calibration and standards--447, 468, 474, 543, 644, 652, 781, 787, 801, 964, 973, 1018, 1078, 1088, 1099, 1117, 1169.
California--38, 57, 58, 68, 96, 457, 576, 785, 836, 884, 904, 925, 981, 992, 1019, 1021, 1134-1136, 1186, 1204, 1209, 1210, 1231, 1232, 1266, 1345, 1420, 1421, 1429, 1646, 1647, 1660, 1699, 1706, 1770, 1912, 1913, 1925, 2043, 2050, 2052, 2088, 2159, 2237, 2358, 2470, 2487, 2535, 2543, 2563, 2564, 2597-2600, 2713, 2717, 2737, 2793, 2803, 2805, 2989, 3310, 3369, 3384, 3399, 3400, 3405, 3425, 3490, 3546, 3547, 3599, 3642, 3647, 3655, 3664, 3669, 3676, 3677, 3728, 3753, 3758, 3766, 3770, 3771, 3840, 3841, 3865, 3868, 3876, 3877, 3930, 3956, 3961, 4005, 4012, 4074, 4119, 4120, 4278, 4490, 4510, 4520, 4540, 4544, 4545, 4648, 4649, 4653, 4655, 4657, 4660, 4716-4721, 4814, 5023, 5031, 5040, 5044, 5053, 5066, 5069, 5080, 5087, 5091, 5182.
Canada--63, 394, 399, 468, 497, 532, 564, 662, 665, 762, 789, 825, 901, 903, 1117, 1139-1141, 1359, 1462-1464, 1526, 1605, 1728, 1861, 1905, 1906, 2170, 2338, 2379, 2502, 2528, 2685, 2711, 2712, 2722, 2723, 2768, 2812, 2963, 3085, 3122, 3183, 3289, 3340, 3341, 3367, 3375-3377, 3732, 3752, 3953, 4034, 4068, 4133, 4140, 4297, 4506, 4579, 4594-4596, 4840, 4875, 4901, 5085.
Canal design--1621, 1670, 1727, 1737, 1744, 1768, 1774, 1808, 1942, 1983, 1986, 1989, 2027, 2029, 2114, 2125, 2177, 2190, 2241, 2294, 2316, 3408.

Canals--934-936, 1201, 1381, 1396, 1508, 1509, 1512, 1513, 1528, 1537, 1545, 1554, 1570, 1579, 1585, 1604, 1634, 1670, 1696, 1737, 1744, 1768, 1808, 1839, 1896, 1905, 1942, 1943, 1971, 1972, 1989, 2027, 2098, 2120, 2125, 2177, 2190, 2196, 2230, 2238, 2295, 2316, 2400, 2435, 2896, 3060, 3408, 3409, 3495, 3505, 3506, 3511, 3577, 3592, 3595, 3668, 3689, 3706, 3782, 3814, 3862, 3888, 3890, 3940, 3951, 4002, 4086, 4104, 4148, 4150, 4157, 4187, 4190, 4198, 4210, 4250, 4296, 4316, 4317, 4346, 4350, 4357, 4358, 4366-4368, 4372, 4392-4394, 4411, 4427, 4456, 4457, 4461, 4470, 4474, 4479, 4482, 4486, 4487, 4489, 4491, 4494, 4499, 4503, 4505, 4508-4512, 4517, 4521-4525, 4530-4532, 4534, 4537-4539, 4541, 4546, 4547, 4549, 4552-4557, 4559, 4560, 4564, 4565, 4574, 4577, 4589, 4601, 4609, 4611, 4617, 4620, 4625, 4630, 4634-4645, 4647, 4651, 4652, 4654, 4656, 4657, 4659, 4661, 4665-4669, 4671, 4672, 4675, 4677, 4678, 4682, 4683, 4688, 4693, 4695, 4698-4704, 4709, 4723, 4735, 4736, 4739, 4753, 4761, 4775, 4779-4782, 4786, 4788, 4789, 4806-4812, 4814, 4820, 4821, 5033, 5068, 5164
Ceylon--1685, 2111, 2908, 3060, 4349.
Channel design--1211, 1220, 1232, 1243, 1302, 1340, 1391, 1399, 1400, 1401, 1412, 1443, 1453, 1581, 1635, 1723, 1737, 1740, 1760, 1769, 1787, 1799, 1800, 1834, 1835, 1864, 1885, 1909, 1923, 1933, 1967, 1989, 1999, 2000, 2007, 2015, 2017, 2018, 2033, 2037, 2038, 2045, 2060, 2067, 2071, 2072, 2080-2082, 2092, 2095, 2149, 2155, 2156, 2162, 2164, 2240, 2242, 2244, 2245, 2255, 2256, 2270-2273, 2275, 2296, 2304, 2336, 2354, 2360, 2364, 2390, 4470, 4766, 4771.
Channel erosion--1391, 1399, 1400, 1401, 1621, 2000, 2027, 2071, 2304, 4766.
Channel flow--1189, 1190, 1237, 1256, 1293, 1325, 1326, 1329, 1332, 1339, 1412, 1419, 1443, 1723, 1787, 1808, 1834, 1898, 1933, 1958, 1959, 1961, 1999, 2006, 2017, 2026, 2029, 2033, 2037, 2038, 2092, 2149, 2156, 2187, 2202, 2243, 2250, 2271, 2274, 2275, 2336, 2360, 2390, 2685, 3525, 4362.
Channel roughness--1189, 1325, 1412, 1967, 2000, 2045, 2092, 2095, 2149, 2202, 2244, 2273, 2296, 2390.
Channel trenching and stabilization--1231, 1266, 1269, 1293, 1399-1401, 1453, 1727, 1737, 1760, 1765, 1799, 1800, 1885, 2071, 2072, 2255, 2256, 2304, 2352, 3196, 4477, 4518, 4601, 4604, 4605, 4616, 4665, 4723, 4766.
Chemical amendments for salinity control--382, 454, 821, 864, 964, 1136, 1176, 1766, 1781, 1868, 2325, 2437, 2438, 2596, 2633, 2664, 2789, 2800, 2881, 2930, 2932, 3591, 3612, 3617, 3627, 3637, 3661, 3664, 3675, 3676, 3681, 3701, 3713, 3731, 3733, 3745, 3752, 3763, 3764, 3837, 3839, 3858, 3860, 3882, 3900, 3916, 3966, 3977, 3992, 3997, 4000, 4007-4009, 4042, 4069, 4077, 4246, 4710.
Chemical analysis of drainage waters--511, 1136, 1160, 1323, 1597, 1631, 2493, 2610, 2828, 2961, 2962, 3918, 5084.
Chemical analysis of irrigation and surface waters--840, 841, 913, 982, 1159, 1797, 2467, 2554, 2685, 2825, 2828, 2843, 2953, 2963-2966, 3708.
Chemical properties of soils--455, 520, 576, 595, 654, 655, 666, 756, 761, 770, 821, 892, 899, 900, 929, 931, 951, 960, 1014, 1036-1038, 1042, 1043, 1052, 1074, 1080, 1081, 1136, 1142, 1176, 1796, 2428, 2433, 2440, 2442, 2446, 2468, 2509, 2546, 2573, 2599, 2647, 2680, 2681, 2683, 2701, 2735, 2750, 2758, 2804, 2843, 2849, 2852, 2883, 2901, 2902, 2904, 2905, 2908, 2917, 2921, 2940, 2953, 2979, 2983, 2984, 3661, 3778, 3998, 4063, 4896.
Chemical weed control--1635, 2270, 2494, 4478, 4480, 4481, 4486-4488, 4503, 4504, 4515, 4527, 4531, 4546, 4547, 4579, 4583-4586, 4593, 4610, 4618-4621, 4624, 4628, 4646, 4655, 4683, 4685, 4692, 4693, 4696, 4702, 4724, 4749, 4750, 4761, 4762, 4764, 4775, 4790, 4793, 4794, 4796, 4813, 5061, 5071, 5089.
China--30, 148, 231, 242, 268, 482, 483, 485, 489, 490, 575, 580, 581, 655, 667, 668, 752, 753, 1051, 1123, 1177, 1178, 1309, 1347, 1395, 1542, 1788b, 1940, 2277, 2632, 2957, 3222, 3545, 3769, 3773, 3774, 3804, 3831, 4013, 4057-4059, 4079, 4081, 4462, 4870.
Clogging of drains--3380, 3381, 3389, 3391, 3400, 3417, 3446, 3451, 3467, 3479, 3500.
Closed drains--558, 1312, 1623, 1828, 1855, 1863, 1921, 2033, 2064, 2100, 2142, 2192, 2302, 2348, 2365, 2374, 2420, 2700, 2855, 2897, 3026, 3084, 3283, 3291, 3300, 3307, 3330, 3349, 3352, 3354, 3364, 3365, 3370, 3373, 3379, 3398, 3418, 3428, 3437, 3442, 3449, 3451, 3454, 3455, 3457, 3475, 3489, 3497, 3668, 3941, 4027, 4403, 4416, 4697, 4707, 4734, 4934, 4973, 5020, 5022.
Collector drains--1763, 3549.
Colorado--29, 689, 1151, 1207, 1216, 1217, 1250, 1315, 1319, 1426, 1765, 1999, 3333, 3604, 3722, 3723, 3737, 3970, 4075, 4150, 4523-4526, 4729-4731, 4733.
Computer study--508, 1241, 1268, 1324, 1329, 1459, 1479, 1557, 1644, 1645, 1766, 1767, 1788a, 1870, 1880, 1924, 1958, 2060, 2179, 2180, 2203, 2223, 2231, 2257, 2300, 2318, 2357, 2545.
Connecticut--504, 653, 1336, 4684, 5086.
Contour trenches--1203, 3080, 3167, 3172, 3173, 3178, 3261.
Crop rotations--2213, 2678, 2945, 3619, 3839, 3914, 3970, 3990, 4076, 4079, 4937.
Crop soils--230, 380, 459, 604, 655, 674, 677, 693-696, 703, 753, 791-794, 813, 833, 834, 837, 847, 862, 877, 957, 983, 985, 1025, 1039, 1040, 1044, 1049, 1080, 1081, 1162-1165, 1175, 1176, 1940, 1952, 1998, 2131, 2226, 2398, 2490, 2574, 2594, 2609, 2632, 2666, 2674-2676, 2680, 2767, 2771, 2776, 2898-2905, 2908, 2909,

Crop soils cont'd--2928, 2983-2986, 3072, 3140, 3414, 3459, 3516, 3738, 3777, 3809, 3859, 3914, 3927, 3928, 4023, 4551, 4591, 4791, 4850, 4851, 4872.
Culvert design--1724, 1939, 1969, 2241, 2272, 2306, 2415.
Czechoslovakia--187, 249, 267, 330, 335, 354, 740, 782, 783, 848, 1791, 1808, 1941, 2118, 2323, 2559, 2590, 2641, 2987, 3407, 3436, 3648, 3782, 3837, 3894, 4283, 4307, 4436, 4437, 4690, 4979, 4988.

Dams--1207, 1336, 1348, 1359. 1369, 1491, 1497, 1503, 1531, 1550-1552, 1560, 1569, 1580, 1582, 1583, 1587, 1591, 1711, 1915, 4411, 4496, 4529, 5037.
Delaware--13, 28, 3954, 4593, 5043.
Delta areas--24, 1311, 1337, 1364, 1470, 1477, 1564, 1610, 1704, 1761, 1817, 1879, 1990, 2204, 2602, 3083, 3100, 3761, 3975, 4512, 5118, 5136, 5180.
Denmark--32, 51, 164, 170, 201, 203, 261, 282, 323, 324, 1745, 1771, 2440, 2537, 2702, 2878, 2879, 3282, 3466, 3467, 3811, 4162, 4279, 4739, 4876, 4946, 4951, 4972, 4981, 4994, 5113, 5157, 5167, 5176.
Deposits in drainage pipes--3282, 3342, 3343, 3355, 3389, 3417, 3451, 3466, 3471.
Detention type structures--65, 1915, 2819, 5025.
Dike design--1589, 1590, 1592, 1594, 1595, 1908-1911, 2388.
Dikes--569, 978, 1284, 1336, 1381, 1540, 1555, 1589, 1590, 1592-1596, 1908-1911, 1915, 2152, 2186, 2199, 2204, 2272, 2286, 2313, 2331, 2388, 2558, 3223, 3359, 3512, 3573, 3681, 3733, 3749, 3915, 3932, 4297, 4327, 4469, 4485, 4506, 4509, 4533, 4569, 4579, 4587, 4590, 4600, 4664, 4684, 4691, 4710, 4734, 4752, 4760, 4769, 4818, 5073, 5083, 5095, 5110, 5162.
Ditch and canal linings--509, 1512, 1527, 1575, 1967, 1984, 2114, 2896, 3505, 3577, 3595, 3666, 3778, 3862, 3940, 3991, 4116, 4210, 4317, 4326, 4363, 4368, 4387, 4394, 4456, 4457, 4461, 4470, 4471, 4474, 4476, 4479, 4482, 4491, 4494, 4497, 4499-4501, 4505, 4508, 4509, 4511, 4513, 4517, 4521, 4530, 4532, 4537, 4539, 4564, 4565, 4574-4576, 4581, 4582, 4589, 4611, 4615, 4617, 4625, 4631-4645, 4647-4652, 4656, 4657, 4660, 4667, 4668, 4671, 4672, 4677, 4678, 4682, 4688, 4694, 4698-4701, 4704, 4709, 4716-4718, 4727-4732, 4736-4738, 4745, 4751, 4753, 4771, 4776, 4782, 4786, 4788, 4806, 4807, 4809-4812, 4814, 4820, 4821.
Ditch cleaning machinery--2271, 4090, 4113, 4137, 4191-4193, 4234, 4[illegible]49, 4316, 4327, 4379-4381, 4385, 4481, 4495, 4514, 4515, 4535, 4536, 4543, 4552, 4554, 4555, 4558, 4560, 4562, 4570, 4612, 4623, 4628, 4629, 4668, 4675, 4676, 4680, 4685, 4708, 4713-4715, 4735, 4737, 4740, 4743, 4744, 4749, 4750, 4757, 4758, 4761, 4762, 4765, 4767, 4770, 4798, 4799, 4801-4805, 4818.
Ditching with explosives--3323, 4134, 4207, 4243, 4355, 4359, 4386, 4390, 5020.
Diversion ditches--65, 1555, 1636, 1641, 1659, 1662, 1663, 1681, 1732, 1777, 2196, 2331, 2540, 3032, 3067, 3085, 3161, 3303, 4501, 5026, 5030,
Diversion terraces--1838, 2175, 2327, 2420, 3006, 3016, 3027, 3052, 3067, 3158, 3263, 5027, 5028, 5032, 5036.
Drainage and irrigation pipes--1548, 1682, 1719, 1758, 1894, 1990, 2003, 2019, 2116, 2129, 2217, 2307, 2366, 2374, 2375, 2387, 2409, 3069, 3280, 3284-3286, 3298, 3301, 3301, 3303, 3322, 3328, 3329, 3337, 3347, 3350, 3355, 3357, 3381, 3389, 3392, 3397, 3399, 3421, 3447, 3449, 3451, 3460, 3461, 3466, 3467, 3471, 3474, 3489, 3492, 3495, 3963, 4096, 4105, 4109-4112, 4122, 4125, 4142, 4146, 4148, 4151, 4153-4156, 4159-4161, 4169, 4173, 4182, 4184-4186, 4196, 4199, 4203-4205, 4225, 4231-4233, 4235-4237, 4242, 4251, 4253, 4263, 4278, 4294, 4320, 4321, 4325, 4326, 4334, 4335, 4343, 4361, 4382, 4393, 4395, 4407, 4408, 4412, 4417, 4418, 4419, 4426, 4439-4441, 4443, 4445, 4447-4449, 4453-4455, 4465, 4468, 4516, 4528, 4660, 4681, 4806, 4812.
Drainage book--122, 146, 161, 163, 172, 184, 189, 190, 194, 195, 208, 216, 217, 220, 229, 232, 237, 239, 249, 250, 251, 266, 267, 273, 275, 294, 295, 299, 301, 303, 304, 308, 317, 320, 330, 332, 333, 335, 336, 347, 349, 350, 354, 398, 536, 537, 590, 1084, 1156, 1341, 1349, 1407, 1455, 1492, 1501, 1521, 1534, 1541, 1543, 1544, 1546, 1547, 1562, 1565, 1571, 1572, 1576-1578, 1722, 1732, 2033, 2040, 2309, 2329, 2330, 3703, 3779, 3891, 3892, 4018, 4364.
Drainage camera--4396, 4774.
Drainage conference--187, 1522, 3861, 3891, 3892, 4026, 4893, 5099.
Drainage depth--1252, 1616, 1688, 1691, 1702, 1722, 1745, 1788a, 1829, 1830, 1831, 1851, 1865, 1866, 1872, 1878, 1882, 1884, 1889, 1905, 1924, 1990, 2064, 2112, 2142, 2145, 2238, 2249, 2308, 2377, 2404, 2405, 2408, 2409, 2441, 2756, 2891, 2909, 2936, 3408, 4037, 4828, 5016.
Drainage discharge--1603, 1628, 1812, 1830, 1846, 1883, 1901, 1921, 1969, 2004, 2012, 2213-2215, 2245, 2280, 2297, 2340, 2347, 2368, 2387, 2411, 2415, 2534, 2906, 2959, 4222, 4280, 4459.
Drainage districts--1, 3, 13, 15, 17, 48, 65, 74, 75, 79, 80, 82, 96, 102, 104, 108, 121, 138, 142, 143, 152, 199, 221, 292, 541, 1011, 1238, 1266, 1275, 1277, 1317, 1345, 1372, 1396, 1398, 1450, 1775, 1785, 2112, 2435, 3495, 3511, 3956, 4012, 4226, 4490, 4518, 4569, 4819, 5040, 5052, 5058.
Drainage filters--2217, 2237, 2258, 3274, 3311, 3319, 3342, 3357, 3368, 3382, 3384-3386, 3394, 3399, 3416, 3422, 3451, 3464, 3473, 3477, 3480, 3485, 3490, 3958, 4096, 4107, 4202, 4225, 4237, 4247, 4326, 4344, 4458, 4777.

Drainage gate--1549, 2040, 2222, 3532, 4288, 4338.

Drainage groups--14, 159, 177, 208, 235, 238, 252, 265, 306, 401, 421, 465, 482, 490, 541, 558, 578, 621, 634, 670, 688, 715, 716, 735, 736, 739, 756, 766, 767, 782, 783, 817, 844, 872, 882, 892, 950, 955, 956, 958, 960, 967, 984, 971, 984, 991, 993, 995, 997, 999, 1003, 1004, 1013, 1036, 1073, 1074, 1076, 1106, 1112, 1125, 1137, 1172-1176, 1180, 1181, 1183, 1188, 1201, 1255, 1260, 1313, 1331, 1342, 1360, 1362, 1363, 1405, 1408, 1409, 1439, 1445, 1452, 1475, 1569, 1599, 1606, 1612, 1619, 1620, 1630, 1632, 1697, 1700, 1704, 1714, 1722, 1730, 1742, 1748, 1768, 1777, 1791, 1816, 1826, 1836, 1840, 1847, 1849, 1881, 1928, 1930, 1932, 1952, 1978, 1995-1998, 2002, 2064, 2067, 2073, 2074, 2084, 2115, 2118, 2119, 2141, 2144, 2146, 2181, 2193, 2212, 2225, 2251, 2252, 2259, 2265, 2267, 2312, 2321, 2326, 2344, 2367, 2388, 2422, 2427, 2431, 2440, 2443, 2471, 2497, 2512, 2521, 2531, 2540, 2547, 2552, 2553, 2558, 2572, 2579, 2781, 2604, 2616-2618, 2621, 2630, 2634, 2648, 2666, 2672, 2674-2678, 2681, 2682, 2696, 2708, 2720, 2744, 2750, 2776, 2781, 2786, 2787, 2796, 2807, 2809, 2829, 2831, 2833, 2834, 2836, 2838, 2840, 2842, 2843, 2845-2848, 2866, 2867, 2869, 2870, 2880, 2885, 2940, 2942, 2944, 2950, 2972, 2980, 2987, 2992, 3039, 3058, 3110, 3216, 3249, 3309, 3401, 3410, 3432, 3437, 3469, 3487, 3497, 3502, 3503, 3532, 3535, 3574, 3580, 3596, 3607, 3633, 3649, 3664, 3671, 3706, 3711, 3718, 3749, 3777, 3784, 3809, 3814, 3827, 3841, 3848, 3857, 3862, 3872, 3883, 3890, 3893, 3909, 3976, 4011, 4023, 4042, 4061, 4071, 4106, 4133, 4269, 4285, 4289, 4297, 4299, 4331, 4367, 4397, 4400, 4420, 4430, 4431, 4435, 4442, 4566, 4567, 4579, 4600, 4822, 4825-4833, 4835-4841, 4843, 4845, 4846, 4848, 4850-4856, 4858-4860, 4863, 4865-4870, 4873-4879, 4881-4892, 4894, 4895, 4897-4906, 4908-4912, 4918-4930, 4932-4941, 4944-4948, 4958, 4963, 4973, 4984, 4988, 4990-4992, 4998, 5000, 5003, 5011, 5017, 5020-5022, 5029, 5033, 5039, 5051, 5053, 5062, 5073, 5077-5079, 5081-5083, 5086, 5088, 5090, 5092, 5095, 5096, 5145.

Drainage machinery--86, 1342, 1532, 1636, 1677, 1679, 1813, 1814, 1848, 1900, 1981, 1990, 2088, 2097, 2194, 2201, 2265, 2303, 2307, 2707, 2785, 2972, 3041, 3045, 3090, 3125, 3150, 3173, 3194, 3200-3202, 3206, 3209, 3235, 3249, 3276, 3290, 3310, 3314, 3325, 3333, 3344-3346, 3379, 3402, 3419, 3426, 3429, 3434, 3438, 3448, 3462, 3473, 3563, 3654, 3746, 3791, 3877, 3898, 3899, 3929, 4062, 4087-4092, 4096, 4098, 4101, 4103-4106, 4113-4116, 4118-4120, 4124, 4128, 4130-4133, 4135-4140, 4143-4145, 4149, 4152-4154, 4158, 4162-4164, 4167, 4168, 4174, 4177, 4179-4181, 4183, 4185-4187, 4189, 4191-4194, 4197, 4198, 4200, 4201, 4206, 4208-4218, 4220, 4221, 4229, 4234, 4239-4241, 4244, 4249, 4250, 4255-4263, 4266, 4267, 4269, 4270, 4273, 4276, 4277, 4279, 4282-4285, 4287, 4289-4293, 4295, 4297-4300, 4302, 4303, 4307-4309, 4311-4318, 4322, 4323, 4327-4333, 4337, 4341, 4348-4354, 4356, 4364-4367, 4371, 4373-4375, 4377-4381, 4385, 4388, 4392, 4397, 4399-4405, 4415, 4417, 4420-4424, 4427, 4428, 4430-4437, 4442, 4446, 4451, 4452, 4461, 4462, 4466, 4467, 4506, 4517, 4536, 3541, 4548, 4570, 4629, 4671, 4675, 4707, 4710, 4715, 4737, 4745, 4749, 4765, 4770, 4778, 4782, 4787, 4819, 4854, 4965, 4971, 4973, 4997, 5003, 5005, 5007, 5020, 5022, 5026, 5114, 5115.

Drainage needs--1, 24, 68, 76, 77, 91, 107, 126, 159, 166, 167, 171, 174, 175, 177, 183, 185, 193, 204, 205, 223, 226-228, 240, 243, 248, 252, 254, 256, 258, 261-263, 271, 272, 274, 280, 283, 287, 288, 293, 296, 300, 309, 316, 331, 334, 337, 351, 363, 364, 420, 454, 494, 626, 633, 923, 927, 997, 1004, 1275, 1277, 1288, 1300, 1320, 1405, 1450, 1453, 1466, 1502, 1533, 1608, 1622, 1641, 1660, 1679, 1681, 1684, 1686, 1696, 1708, 1711, 1714, 1715, 1726, 1734, 1758, 1776, 1783, 1801, 1802, 1847, 1872, 1882, 1899, 1907, 1912, 1926, 1936, 1952, 1957, 1980, 2016, 2073, 2087, 2097, 2107, 2108, 2146, 2163, 2188, 2229, 2249, 2253, 2326, 2378, 2450, 2480, 2481, 2513, 2561, 2585, 2592, 2873, 2933, 2968, 2972, 3003, 3031, 3032, 3071, 3082, 3085, 3119, 3161, 3226, 3247, 3287, 3290, 3316, 3331, 3349, 3356, 3371-3373, 3402, 3406, 3411, 3430, 3431, 3444, 3472, 3473, 3488, 3489, 3540, 3547, 3571, 3588, 3593, 3613, 3614, 3672, 3677, 3721, 3741, 3744, 3768, 3778, 3784, 3797, 3798, 3807, 3812, 3827, 3839, 3846, 3862, 3883, 3893, 3909, 3941, 3957, 3986, 4002, 4047, 4052, 4062, 4073, 4075, 4083, 4697, 4830, 4833, 4839, 4864, 4931, 4966, 4971, 5005, 5007, 5031, 5064, 5149, 5150, 5183, 5184.

Drainage organizations--4, 23, 24, 31, 37, 62, 74, 76, 108, 129, 141, 151, 287, 356, 1228, 1277, 1755, 1954, 3317, 3377, 4824.

Drainage outlets--1351, 1396, 1697, 1706, 1872, 1883, 1906, 1922, 2008, 2021, 2023, 2122, 2150, 2222, 2249, 2420, 2766, 3042, 3071, 3112, 3157, 3159, 3217, 3289-3291, 3370, 3420, 3427, 3472, 3509, 3540-3542, 3567, 3577, 3771, 4012, 4062, 4075, 4220, 4376, 4483, 4497, 4594, 4670, 4752, 4968.

Drainage problems--53, 64, 158, 168, 174, 177-179, 181-183, 200-202, 214, 219, 221, 223, 230, 231, 233, 238, 241, 242, 244-246, 248, 253, 255, 259, 260, 264, 265, 268, 277-279, 281-283, 286, 289, 297, 298, 311, 312, 314, 321-323, 325-327, 341, 344, 345, 357-359, 362, 385, 410, 492, 580, 769, 797, 799, 805, 827, 856, 939, 1002, 1191, 1216, 1224, 1250, 1351, 1390, 1424, 1425, 1429, 1431, 1461, 1502, 1518, 1523, 1536, 1557, 1605, 1619, 1632, 1646, 1647, 1653, 1664, 1677, 1706, 1720, 1726, 1729, 1739, 1753, 1755, 1756, 1775, 1779, 1785, 1798, 1811, 1819, 1821, 1825, 1837, 1844, 1845, 1862, 1869, 1897, Drainage Problems cont.--1949, 1973, 1974, 1985, 2001, 2025, 2049, 2056, 2065, 2078, 2079, 2088, 2103, 2120, 2138, 2148, 2176, 2179, 2180, 2198, 2231, 2277, 2278, 2300, 2349, 2365, 2378, 2393, 2395, 2406, 2420, 2427, 2445, 2448, 2478, 2508, 2529, 2561, 2583, 2590, 2670, 2757, 2765, 2794, 2800, 2809, 2825, 2847, 2884, 2885, 2887, 2889, 2912, 2923, 2968, 2987, 3058, 3092, 3120, 3159, 3288, 3310, 3348, 3367, 3378, 3409, 3420, 3427, 3494, 3502, 3512, 3537, 3574, 3577, 3594, 3595, 3614, 3625, 3646, 3649, 3657, 3658, 3682, 3699, 3704, 3707, 3711, 3730, 3740, 3758, 3762, 3766, 3772, 3776, 3778, 3808, 3816, 3828, 3835, 3841, 3847, 3848, 3852, 3855, 3886, 3908, 3922, 3923, 3969, 3976, 3980, 4005, 4023, 4026, 4048, 4055, 4084, 4139, 4200, 4256, 4286, 4293, 4358, 4399, 4429, 4469, 4490, 4533, 4653, 4660, 4678, 4695, 4697, 4768, 4815, 4835, 4839, 4841, 4857, 4874, 4898, 4914, 4915, 4928, 4947, 4960, 4975, 4988, 5048, 5053, 5063, 5074, 5083, 5096, 5145.

Drainage programs--4, 7, 31, 34, 53, 68, 71, 76, 78, 79, 81, 82, 85, 92, 94, 102, 106, 109, 119, 137, 142, 150, 156, 157, 162, 164, 167-170, 173-176, 178-181, 186-188, 192, 198-203, 205-208, 210, 212, 213, 215, 218, 221, 222, 224, 225, 234-236, 238, 246, 247, 254, 256, 257, 259, 260, 262-265, 270, 271, 274, 276, 278, 279, 281, 284, 285, 287, 290-293, 297, 302, 305-307, 310, 312-316, 319, 321, 322, 324, 325, 328, 329, 337, 339, 340, 342-344, 346, 349, 352, 355, 356, 358, 360-364, 522, 562, 850, 927, 971, 1198, 1214, 1228, 1245, 1248, 1258, 1273, 1277, 1330, 1335, 1339, 1360, 1365, 1368, 1393, 1394, 1404, 1408, 1411, 1427, 1439, 1471, 1478, 1490, 1677, 1686, 1690, 1708, 1748, 1755, 1785, 1789, 1807, 2034, 2062, 2065, 2067, 2118, 2143, 2210, 2317, 2326, 2478, 2498, 2561, 2583, 2755, 2817, 2947, 2958, 3159, 3317, 3348, 3367, 3404, 3424, 3438, 3532, 3621, 3640, 3696, 3706, 3718, 3838, 3854, 3873, 3905, 3922, 3926, 4200, 4256, 4358, 4663, 4742, 4768, 4815, 4918, 4947, 4966, 5005, 5074, 5121, 5129, 5133, 5141, 5142, 5151, 5152, 5158, 5160, 5170-5172, 5178, 5181, 5183.

Drainage spacings--1252, 1610, 1617, 1643, 1691, 1692, 1700, 1702, 1736, 1745, 1762, 1763, 1772, 1788a, 1804, 1830, 1831, 1851, 1865, 1866, 1882, 1901, 1905, 1924, 1990, 2002, 2013, 2057, 2058, 2112, 2113, 2142, 2145, 2147, 2182, 2215, 2216, 2249, 2308, 2311, 2314, 2315, 2362, 2373, 2408, 2409, 2497, 2603, 2756, 2773, 2854, 3319, 3353, 3531, 4140.

Drainage structures--1724, 1725, 1734, 1752, 1839, 1853, 3015, 3318, 3601, 4095, 4097, 4108, 4219, 4783, 4808.

Drainage survey--1815, 1999, 2847, 3566.

Eastern United States--26, 27, 43, 124, 130, 558, 1092, 1206, 1211, 1233, 1226, 1378, 1432, 1887, 1888, 1893, 2270, 2725, 2853, 2955, 3029, 3052, 3064, 3065, 3085, 3092, 3111, 3112, 3556, 3573, 3951, 5016.

Economics--2, 3, 19, 24, 34, 41, 49, 51, 71, 73, 78, 81, 84, 85, 87, 91, 92, 94-96, 99, 100, 105-107, 111, 113, 115, 121, 126, 136, 137, 139, 140, 147, 177, 199, 221, 244, 245, 252, 282, 307, 338, 541, 614, 780, 785, 827, 853, 892, 1004, 1007, 1152, 1193, 1194, 1196, 1228, 1233, 1241, 1247, 1250, 1270, 1279, 1296, 1297, 1312, 1319, 1330, 1342, 1365, 1372, 1404, 1411, 1425, 1438, 1448, 1465, 1469, 1471, 1483, 1486, 1490, 1600, 1601, 1614, 1632, 1637, 1638, 1646, 1660, 1678, 1704, 1706, 1749, 1783, 1793, 1839, 1881, 1882, 1912, 1926, 1957, 1971, 1972, 2011, 2016, 2039, 2075, 2076, 2086, 2195, 2201, 2258, 2292, 2310, 2354, 2355, 2370, 2435, 2448, 2473-2475, 2498, 2528, 2545, 2551, 2553, 2605, 2633, 2641, 2652, 2679, 2711, 2785, 2854, 2857, 2867, 2937, 2995, 3004, 3008, 3026, 3028, 3030 3038, 3041, 3079, 3084, 3099, 3113, 3116, 3120, 3122, 3125, 3129, 3131, 3143, 3148, 3198, 3207-3209, 3211, 3212, 3215, 3225, 3231, 3242, 3268, 3288, 3293, 3294, 3296, 3305, 3310, 3313, 3314, 3324, 3327, 3340, 3344, 3358, 3364, 3370, 3386, 3390, 3392, 3405, 3415, 3426, 3436, 3437, 3447, 3468, 3476, 3507, 3509, 3542, 3544, 3550, 3556-3558, 3579, 3604, 3663, 3667, 3669, 3685, 3697, 3698, 3703, 3746, 3761, 3763, 3768, 3771, 3795, 3840, 3872, 3876, 3877, 3893, 3894, 3911, 3922, 3953, 3956, 3977, 3987, 4033, 4043, 4047, 4076, 4083, 4094, 4097, 4098, 4102, 4117, 4119, 4120, 4128, 4144, 4147, 4149, 4158, 4164, 4173, 4194, 4206, 4213, 4226, 4238, 4250, 4256, 4268, 4278, 4329, 4333, 4334, 4342, 4355, 4362, 4384, 4392, 4408, 4456, 4458, 4485, 4512, 4514, 4521, 4526 4527, 4556, 4559, 4572, 4576, 4582, 4588, 4628, 4635, 4636, 4642, 4643, 4645, 4648, 4652, 4698, 4699, 4704, 4725, 4738, 4748, 4776, 4783, 4807-4810, 4812, 4814, 4818, 4839, 4841, 4878, 4929, 4969, 4971, 4976, 4987, 4995, 5005, 5012, 5020, 5022, 5032, 5045, 5047, 5079, 5102, 5122, 5183.

Effect of drainage on fertilizer use--2452, 2473, 2477, 2517, 2518, 2586, 2601, 2623, 2634, 2636, 2637, 2639, 2641, 2662, 2676, 2719, 2745, 2760, 2778, 2785, 2798, 2818, 2827, 2860-2864, 2874, 2875, 2911, 2939, 2954, 2971, 2977, 2979, 2984, 2995, 3439, 3884, 3951, 4106, 4852, 4888, 4937, 4967, 4984, 4990, 4991.

Effect of drainage on diseases and insects--2499, 2519, 2531, 2539, 2625, 2804, 2845, 2846, 2884, 2903, 2979, 2989, 3760, 3884, 4852, 4880, 5060, 5074, 5097.

Effect of sea water and its spray on soils and crops--2469, 2486, 2520, 2521, 2613, 2696, 2800, 2890, 2957, 2983, 3875, 4710.

Equations--373, 597, 599, 602, 707, 718, 760, 948, 1056, 1078, 1195, 1222, 1225, 1227, 1281-1283, 1308, 1352, 1370, 1377, 1432, 1433, 1443, 1525, 1582, 1583, 1586, 1603, 1631, 1634, 1639, 1649, 1658, 1665, 1666, 1671, 1688, 1692, 1720, 1735, 1737, 1739, 1743, 1761, 1765, 1779, 1781, 1787, 1798-1800, 1818-1821, 1823, 1828, 1840, 1861, 1865, 1866, 1868, 1870, 1895, 1901, 1905, 1973, 1975, 1978, 1983, 2005, 2017, 2018, 2029, 2030, 2032, 2037, 2038, 2042, 2056-2058, 2090, 2098, 2113, 2116, 2117, 2136, 2139, 2155, 2156, 2162, 2164, 2169, 2173, 2175, 2180, 2183, 2205, 2223, 2224, 2240, 2257, 2284, 2288-2290, 2309, 2314, 2318, 2322, 2328, 2340, 2348, 2358, 2363, 2367, 2371, 2372, 2386, 2402, 2403, 2792, 3521, 3526-3530, 3560, 3957.

Erosion control--76, 243, 279, 530, 1197, 1202, 1203, 1220, 1235, 1266, 1290, 1293, 1366, 1373, 1399, 1406, 1440, 1460, 1629, 1634, 1641, 1648, 1799, 1800, 2044, 2153, 2229, 2260, 2352, 2479, 2516, 2813, 3005, 3016, 3019, 3025, 3027, 3041, 3046, 3051, 3105, 3108, 3109, 3112, 3116, 3117, 3135, 3164, 3193, 3195, 3228, 3235, 3267-3269, 3332, 3707, 4613, 4684, 4739, 4809, 5008, 5023, 5026, 5027, 5034.

Evaporation--481, 533, 535, 601, 870, 894, 1101, 1154, 1818, 1823, 1865, 1866, 1968, 2495, 2808.

Evapotranspiration--395, 417, 548, 600, 634, 970, 1114, 1138, 1153, 1155, 1657, 2207, 2233, 2377, 2534.

Excessive drainage--1653, 2127, 2488, 2746, 2762, 2770, 2776, 2936, 3935, 4003.

Excessive irrigation--1877, 2827, 3981, 5063, 5072.

Exotic drainage--45, 46, 145, 1637, 1638, 1741, 1815, 1900, 1913, 2135, 2142, 2183, 2327, 2773, 3060, 3260, 3278, 3292, 3298, 3305, 3401, 3420, 3431, 3444, 3476, 3496, 3517, 3770, 4361, 4759.

Farmstead drainage--1887, 1888, 2262, 3744, 4429.

Federal subsidies for drainage--87, 105, 5055, 5057, 5064, 5077.

Field crops--35, 148, 174, 189, 190, 219, 230, 385, 487, 495, 496, 504, 568, 604, 632, 640, 674, 695-697, 701, 715, 716, 762, 790-793, 868, 877, 910, 931, 938, 957, 965, 983-985, 1025, 1039, 1040, 1042-1044, 1049, 1080, 1081, 1162-1165, 1175, 1176, 1379, 1431, 1568, 1659, 1688, 1810, 1940, 1952, 1984, 2013, 2040, 2085, 2109, 2135, 2138, 2201, 2215, 2226, 2233, 2238, 2334, 2384, 2398, 2406, 2421, 2423, 2427, 2447, 2448, 2452, 2453, 2460, 2478, 2503, 2512, 2516, 2517-2519, 2531, 2538, 2540, 2544, 2563, 2564, 2573, 2574, 2576, 2594, 2608, 2626, 2627, 2632, 2633, 2642, 2654, 2655, 2666, 2669, 2674, 2675, 2680, 2688-2691, 2708, 2712, 2714, 2722, 2737, 2759, 2767, 2769, 2773, 2782, 2784, 2788, 2790, 2791, 2792, 2804, 2809, 2814, 2818, 2827, 2844, 2860, 2862, 2863, 2865, 2867, 2869, 2876, 2895, 2898-2905, 2908, 2909, 2925, 2937, 2946, 2978, 2980, 2984, 2994, 3016, 3017, 3018, 3041, 3042, 3051, 3059, 3065, 3066, 3067, 3079, 3093, 3095, 3098, 3101, 3133, 3140, 3144, 3145, 3147, 3173, 3177, 3202, 3207-3213, 3215, 3239-3243, 3259, 3264, 3323, 3349, 3352, 3397, 3414, 3424, 3434, 3459, 3516, 3517, 3532, 3587, 3591, 3593, 3598, 3613, 3614, 3624, 3633, 3640, 3683, 3691, 3727, 3728, 3736, 3738, 3741, 3777, 3785, 3792, 3796, 3809, 3818, 3822, 3825, 3826, 3843, 3859, 3867, 3874, 3887, 3900, 3906, 3907, 3912, 3914-3916, 3924, 3927, 3928, 3944, 3947, 3951, 3970, 3974, 3976, 3983, 3984, 3986, 3990, 4010, 4014, 4024, 4044, 4069, 4082, 4131, 4415, 4447, 4452, 4463, 4540, 4544, 4545, 4572, 4591, 4648, 4649, 4686, 4687, 4719, 4720, 4765, 4768, 4773, 4791, 4850-4852, 4857, 4872, 5020, 5026, 5036, 5045, 5050.

Field investigations--383, 401, 405, 414, 439, 441-443, 474, 501, 524, 439, 540, 574, 643, 689, 713, 805, 826, 829, 830, 906, 964, 1006, 1026, 1089, 1103, 1127, 1145, 1150, 1151, 1306, 1352, 1382, 1419, 1584, 1649, 1693, 1753, 1797, 1821, 1925, 1935, 2050, 2052, 2492, 2555, 2607, 3344, 3603, 4074, 4516, 4718.

Fiji--2513.

Finland--71, 87, 105, 248, 863, 962, 1623, 1884, 1960, 2104, 2142, 2172, 2615-2622, 2635, 2636, 2653, 2684, 2757, 2785-2787, 2797, 2913, 2982, 3250, 3364, 3365, 3379, 3386, 3387, 3438, 3449, 4099, 4201, 4217, 4227, 4234, 4241, 4257, 4285, 4287-4299, 4329, 4330, 4332, 4333, 4342, 4353, 4374, 4392, 4433, 4616, 4778, 4856, 4861, 4862, 4871, 4883, 4897, 4909, 4912, 4948, 4961, 4968-4970, 4973, 4974, 4984, 4985, 4990, 4995-4997, 5003, 5022, 5152, 5170.

Fish and wildlife--118, 142, 160, 1197, 1206, 1207, 1242, 1265, 1288, 1369, 1425, 1438, 1451, 1460, 1466, 1489, 1491, 1887, 1888, 2043, 2270, 2491, 2553, 2740, 4552, 4568, 4726, 4945, 5016, 5037, 5039, 5041, 5042a, 5043, 5049-5051, 5054-5059, 5061, 5062, 5064, 5065, 5067, 5068, 5076-5079, 5081, 5084-5092, 5097, 5099.

Flood peaks--1211, 1274, 1374, 1376, 1417, 1443.

Flood retarding structures--1209, 1210, 1223, 1279, 1298, 1348, 1375, 1491, 2222.

Florida--50, 88, 143, 1011, 1014, 1199, 1252, 1260, 1275, 1398, 1428, 1574, 1761, 1774, 1775, 1825, 1881, 1882, 2110, 2258, 2261, 2355, 2378, 2432, 2539, 2603, 2648, 2765, 2784, 2888, 2909, 3319, 3342, 3343, 3358, 3451, 3471, 3489, 3511, 3531, 3601, 3759, 3760, 4032, 4206, 4624, 4721, 4794, 5042b, 5174.

Flow in rough conduits--2100, 2101, 2102.

Flowers and shrubs--158, 2087, 2089, 2463, 2466, 2467, 2733, 2734, 2794, 2845, 2846, 2890, 3060, 3402, 3444, 3618, 3732.

Flumes--1067, 1513, 1670, 2149, 2202, 2244, 3232, 4346, 4358, 4564, 4606, 4613, 4751, 4788.

France--19, 207, 210, 346, 355, 410, 522, 582, 799, 1077, 1300, 1474, 1522, 1536, 1620, 1629, 1743, 1744, 1817, 1850-1852, 1894, 2005, 2096, 2185, 2246-2248, 2451, 2504, 2566, 2849, 2876, 3061, 3338, 3339, 3362, 3363, 3428, 3696, 3735, 3898, 3923, 4142, 4145, 4196, 4367, 4554, 4555, 4565, 4671, 4863, 4889, 4933, 5008.

Fruit and nut crops--245, 261, 288, 296, 358, 382, 390, 412, 726, 931, 938, 1018, 1019, 1021, 1128, 1199, 1611, 1684, 1685, 1849, 1872, 1881, 1899, 1907, 1936, 2088, 2103, 2277, 2378, 2468, 2471, 2499, 2507-2509, 2513, 2527, 2541-2543, 2555, 2561, 2597-2600, 2648, 2656, 2717, 2744, 2753, 2766, 2793, 2858, 2916, 2989, 2996-2998, 3008, 3019, 3022, 3029, 3039, 3043, 3048, 3049, 3062, 3073-3076, 3086, 3087, 3119, 3121, 3128, 3130, 3132, 3138, 3149, 3154, 3155, 3160, 3161, 3164, 3165, 3167, 3168, 3170, 3172, 3188, 3189, 3237, 3251, 3253, 3257, 3261, 3272, 3287, 3288, 3298, 3316, 3356, 3371-3373, 3405, 3451, 3471, 3489, 3599, 3622, 3677, 3757-3759, 3812, 3886, 3954, 4016, 4032, 4296, 4335, 4349, 4624, 4676, 4724, 4785, 4945, 5032, 5183.

Georgia--124, 563, 755, 756, 2956, 3148, 3234, 4600, 4602, 5174

Germany--18, 49, 72-74, 76, 77, 79, 80, 84, 95, 114, 117, 129, 141, 156, 167, 173, 183, 198, 202, 212, 219, 225, 226, 258-260, 264, 279-281, 289, 298, 315, 316, 345, 347, 356, 360, 552, 645, 648, 670, 727, 751, 833, 885, 908, 961, 1109, 1128, 1129, 1214, 1245, 1335, 1411, 1427, 1627, 1651, 1686, 1687, 1702, 1813, 1814, 1889, 1890, 1965, 1982, 1995, 2002, 2020, 2086, 2129, 2168, 2209-2212, 2303, 2389, 2408, 2409, 2417, 2443, 2444, 2476, 2565, 2580, 2581, 2587, 2663, 2696, 2858, 2884, 2907, 2922, 2941-2943, 3077, 3142, 3184, 3193, 3218, 3321, 3336-3348, 3361, 3366, 3394, 3417, 3419, 3421, 3433, 3435, 3445, 3446, 3479, 3491, 3562, 3579, 3580, 3641, 3767, 3781, 3896, 3901, 3935, 3985, 4124, 4160, 4163, 4169, 4172, 4188, 4191-4193, 4214-4216, 4221, 4238, 4243, 4249, 4255, 4256, 4270-4275, 4282, 4292, 4293, 4314, 4318, 4335-4337, 4365, 4371, 4376-4381, 4398, 4401, 4422, 4423, 4443, 4449, 4450, 4465, 4467, 4469, 4485, 4503, 4553, 4571, 4578, 4583-4585, 4618-4623, 4626, 4663, 4673, 4674, 4679, 4713-4715, 4749, 4755-4758, 4760, 4787, 4796, 4815, 4830, 4888, 4890, 4894, 4900, 4919-4921, 4926, 4936, 4946, 4977, 5119, 5132, 5146, 5151, 5160, 5183.

Grass waterways--1348, 1369, 1790, 2010, 2187, 2331, 2392, 3001, 3002, 3015, 3024, 3027, 3028, 3047, 3059, 3090, 3102, 3112, 3115, 3116, 3119, 3126, 3130, 3132, 3146, 3150-3152, 3161, 3191, 3194-3197, 3200, 3203, 3217, 3227, 3232, 3240, 3252, 3420, 4177, 4613, 5034.

Grasses and legumes--1, 176, 219, 258, 341, 344, 374, 391, 436, 495, 532, 568, 605, 613, 614, 621, 799, 896, 897, 1199, 1203, 1599, 1686, 1722, 1783, 1904, 1913, 1921, 2066, 2115, 2182, 2188, 2191, 2215, 2219, 2233, 2448, 2457, 2471, 2488, 2510, 2514, 2515, 2520, 2528, 2532, 2562, 2570, 2575, 2591, 2625, 2637-2640, 2670, 2701, 2707, 2713, 2719, 2730, 2812, 2819, 2820, 2833, 2854, 2856, 2857, 2870, 2884, 2914, 2918, 2919, 2920, 2926, 2927, 2972-2975, 2987, 3001, 3016, 3024, 3032, 3047, 3074, 3080, 3116, 3167, 3172, 3173, 3174, 3178, 3210, 3266, 3309, 3321, 3334, 3410, 3494, 3565, 3694, 3750, 3751, 3853, 3868, 3925, 3950, 3970, 3994, 4001, 4044, 4068, 4123, 4151, 4321, 4388, 4445, 4448, 4498, 4723, 4739, 4827, 4844, 4865, 4906, 4934, 5029, 5045, 5047.

Great Plains--1053, 1434, 1444, 1633, 2570, 3199.

Great soil groups--397, 456, 532, 607, 782, 827, 967, 974, 991, 994, 1001, 1028, 1161, 1183, 2236, 2389, 2694, 2779, 2814, 2854, 2873, 2906.

Greece--3626, 4444.

Ground water--12, 29, 39, 44, 132, 164, 373, 401, 405, 411, 415, 416, 434, 435, 438, 444, 523, 596, 598, 599, 607, 627, 628, 676, 700, 708, 718, 734, 743, 779, 804, 816, 826, 827, 845, 851, 863, 953, 988, 1005, 1029, 1030, 1047, 1066, 1075, 1115, 1116, 1136, 1158, 1159, 1191, 1197, 1201, 1208, 1212, 1213, 1216, 1217, 1220, 1224, 1234, 1241, 1244, 1248, 1250, 1252-1255, 1257, 1261-1263, 1267, 1268, 1270, 1278, 1281-1283, 1294, 1307, 1315, 1316, 1320-1322, 1328, 1333, 1334, 1338, 1341, 1344, 1346, 1347, 1349, 1352, 1353, 1362, 1363, 1370, 1371, 1382, 1385, 1387, 1396, 1398, 1406, 1407, 1413, 1422, 1429-1431, 1435, 1449, 1453, 1456, 1458, 1459, 1461, 1468, 1469, 1479, 1480, 1484, 1487, 1492, 1495, 1497, 1499, 1510, 1538, 1541, 1554, 1562, 1570, 1581, 1586, 1599, 1617, 1639, 1642, 1647, 1650, 1663, 1667-1669, 1671, 1688, 1691, 1692, 1694, 1695, 1700, 1704, 1716, 1717, 1730, 1735, 1739, 1744, 1746, 1753, 1773, 1779, 1784, 1786, 1792, 1803, 1809, 1815, 1818, 1826, 1828, 1832, 1841, 1843, 1844, 1857-1859, 1865, 1867, 1871, 1873-1877, 1883, 1886, 1897, 1924, 1925, 1944, 1955, 1956, 1973, 1976, 1977, 1995, 2028, 2031, 2032, 2039, 2042, 2046, 2047, 2050, 2053, 2054, 2056-2058, 2063, 2078, 2079, 2094, 2105, 2109, 2117, 2126-2128, 2135, 2151, 2198, 2207, 2208, 2216, 2218, 2220, 2224, 2229, 2231, 2291, 2295, 2299, 2318, 2319, 2332, 2335, 2337, 2341, 2342, 2359, 2368, 2377, 2394, 2395, 2397, 2401, 2409, 2410, 2413, 2419, 2441, 2451, 2462, 2485, 2497, 2554, 2575, 2581, 2603, 2637, 2638, 2640, 2685, 2715, 2742, 2747, 2748, 2754, 2793, 2854, 2872, 2906, 2918-2920, 2925, 2935, 2940, 2943, 2944, 2968, 2974, 2975, 3026, 3498, 3508, 3514, 3515, 3519-3523, 3525-3531, 3542, 3546, 3548, 3559, 3560, 3576-3578, 3605, 3625, 3646, 3708, 3710, 3720, 3722, 3724, 3730, 3739, 3752, 3827, 3830, 3836, 3841, 3859, 3930, 3933, 3935, 3970, 3980, 3995, 3997, 4005, 4034, 4041, 4862, 4972, 5035.

Growth chambers--2344, 2723.

Hawaii--390, 937, 938, 1161, 1659, 2124, 2490, 3144, 3145, 3670, 4439, 4447, 5026.
History--6, 7, 14, 24, 30, 33, 36, 45, 46, 61, 75, 86, 89, 97, 102, 103, 107, 109, 110, 112, 114, 123, 127, 128, 142, 144, 146, 147, 148, 149, 154, 155, 244, 273, 338, 349, 350, 812, 879, 927, 1231, 1259, 1288, 1428, 1761, 1776, 2133, 2307, 2419, 2424, 2785, 2868, 3071, 3085, 3158, 3317, 3359, 3454, 3455, 3481, 3493, 3537, 3588, 3699, 3811, 3847, 3848, 3975, 4080, 4101, 4170, 4294, 4405, 4569, 4833, 4839, 4905, 5005, 5108, 5109, 5118, 5131, 5154, 5156, 5164.
Horizontal drainage--1503, 1625, 1735, 1804, 2174, 3584, 3623, 4051.
Horticultural crops--240, 1653, 2480, 2481, 2482, 2649, 2850.
Humid areas--337, 1683, 2569, 3667, 3798, 3975, 4210, 4211, 4212.
Hungary--382, 555, 571, 866, 956, 1033, 1035, 1079, 1381, 1579, 1966, 2196, 2438, 3131, 3138, 3272, 3692-3695, 3750, 3751, 3911, 3936, 3938, 3973, 3978, 3981, 4006-4010, 4159, 4263, 4343, 4369, 4419, 4651, 4659, 4688.
Hydraulic design--1558, 1560.
Hydrographs, hyetographs, and hodographs--684, 685, 1276, 1291, 1346, 1370, 1377, 1388, 1437, 1494, 1639, 1716, 1886, 2014.

Iceland--175, 222, 246, 1954, 4843, 4845, 4877.
Idaho--830, 961, 4534, 4538, 5029.
Illinois--21, 22, 42, 90, 397, 579, 656, 788, 874, 1143, 1276, 1350, 1724, 1725, 1946, 2094, 2996, 3127, 3403, 3576, 4658, 5032.
India--163, 301, 521, 698, 699, 717, 898, 899, 958, 979, 1050, 1339, 1367, 1468, 1685, 1737, 1752, 1816, 1847, 1848, 2105, 2169, 2176, 2228, 2327, 2332, 2333, 2335, 2423, 2574, 2642, 2663, 2759, 2813, 2847, 2933, 3058, 3088, 3040, 3142, 3178, 3370, 3411, 3591, 3595, 3674, 3701, 3702, 3777, 3780, 3784, 3814, 3862, 3871, 3873, 3874, 3883, 3890, 3900, 3952, 3999, 4029, 4042, 4044, 4077, 4704, 5026, 5036, 5104, 5153.
Indiana--107, 299, 927, 1193, 1312, 1438, 1494, 2419, 2474, 2601, 3194, 3226, 3227, 3229, 3462, 3463, 4136.
Indonesia--542, 2895.
Infiltration--391, 396, 407, 429, 437, 440, 464, 466, 503, 507, 569, 572, 584, 617, 625, 664, 677, 684, 685, 712, 753, 795, 811, 847, 859, 864, 867, 869, 896, 897, 943, 947-949, 965, 969, 970, 974, 989, 998, 1001, 1031, 1032, 1082, 1105, 1178, 1327, 1454, 1520, 1633, 1649, 1652, 1705, 1840, 1861, 1870, 1877, 1911, 2078, 2079, 2121, 2131, 2223, 2284, 2363, 2440, 2535, 2893, 2930, 3296, 3995, 4550, 4587.
Installation of equipment--365, 729, 776, 861, 989, 1011, 1021, 1026, 4425.
Iowa--8, 65, 128, 135, 199, 835, 838, 839, 980, 1276, 1348, 1425, 1845, 1922, 2013, 2216, 2233, 2343, 2452, 2453, 2545, 3116, 3123, 3166, 3182, 3217, 4518, 4662, 5076, 5090.
Iran--3625, 3628, 3700, 3778, 3861, 4026.
Iraq--64, 325, 523, 633, 692, 1001, 1410, 1914, 1949, 2881, 3659, 3660, 3703, 3709, 3721, 3852, 3888, 3993, 4064, 4495.
Iron bacteria--3342, 3343, 3355, 3389, 3395, 3451, 3471.
Irrigation and drainage--799, 1364, 1665, 1816, 1984, 2231, 2232, 2346, 2414, 2427, 2477, 2562, 2581, 2601, 2765, 2935, 3024, 3070, 3182, 3436, 3587, 3641, 3651-3654, 3690, 3691, 3699, 3724, 3734, 3781, 3793, 3795, 3820, 3840, 3841, 3915, 3924, 3941, 3942, 3954, 3963, 3964, 3968, 3989, 4020, 4033, 4038, 4053, 4068, 4071, 4085, 4125, 4238, 4247 4260, 4407, 4408, 4413, 4440, 5164.
Irrigation efficiency--4072, 4672, 5070.
Irrigation tailwater systems--1738, 2894, 2970, 3568, 3710, 3956, 4066.
Israel--108, 214, 603, 627, 628, 1159, 1330, 1781, 1826, 1841, 1971, 1972, 2194, 2370, 2486, 2624, 2679, 3151-3153, 3450, 3699, 3729, 3854, 3882, 4881.
Italy--9, 10, 15, 62, 140, 171, 174, 185, 186, 262. 297, 309, 313, 479, 886, 932, 1121, 1235, 1236, 1390, 1471, 1473, 1566, 1705, 1707-1709, 1733, 1828, 1860, 2119, 2141, 2171, 2314-2316, 2450, 2483, 2505, 2506, 2762, 2772, 2842, 2859, 2916, 3004, 3033, 3034, 3036, 3050, 3055-3057, 3089, 3137, 3162, 3177, 3245, 3424, 3707, 3821, 3927, 3928, 3947, 3948, 4002, 4148, 4170, 4231, 4313, 4320, 4360, 4413, 4463, 4493, 4541, 4661, 4682, 4691, 4696, 4709, 4918, 5120, 5125.

Japan--65, 230, 250, 251, 379, 380, 594, 641, 654, 673, 674, 677, 693-697, 700, 701, 703, 715, 716, 720-723, 791-794, 813, 820, 851, 862, 957, 958, 983, 984, 1027, 1038-1044, 1049, 1060-1062, 1080, 1081, 1162-1165, 1172-1176, 1271, 1313, 1320, 1328, 1379, 1424, 1457, 1495, 1535, 1540, 1549-1553, 1555, 1568, 1569, 1587, 1589-1596, 1809-1811, 1835, 1908-1911, 1934, 1952, 1980, 2078-2081, 2126, 2138, 2198, 2225, 2226, 2287-2290, 2294, 2295, 2310, 2313, 2361, 2396, 2398-2400, 2637, 2638-2640, 2666, 2674-2676, 2680, 2681, 2687-2691, 2695, 2749, 2750, 2767, 2769, 2771, 2776, 2777, 2868, 2869, 2898-2905, 2915, 2928, 2958, 2978, 2979, 2983-2986, 3120, 3169, 3174, 3246, 3249, 3368, 3414, 3458, 3459, 3476, 3477, 3512, 3516, 3537, 3552, 3738, 3805, 3859, 3872, 3887, 3909, 3914, 3980, 4024, 4323, 4474, 4549-4551, 4587, 4591, 4608, 4614, 4678, 4791, 4792, 4816, 4846, 4850-4852, 4854, 4864, 4872, 4880, 4896, 5033, 5094, 5114, 5115, 5135, 5154, 5161.

Kansas--60, 1277, 1317, 1369, 1433, 1875, 2644, 2645, 3001, 3021, 4220, 4722.
Kentucky--2593.
Korea--985, 1171, 2517.

Laboratory investigations--376, 515, 524, 556, 582, 811, 869, 948, 949, 1310, 1325, 1326, 1419, 1422, 1513, 1546, 1560, 1655, 1670, 1743, 1821, 1823, 1945, 1947, 1948, 1955, 2000, 2022, 2037, 2038, 2053, 2068, 2244, 2297, 2468, 2492, 2555, 2655, 2764, 3344, 3381, 3559, 3603, 3674, 4550, 4718.
Land leveling and land forming--338, 1009, 1607, 1613, 1644, 1660, 1682, 1704, 1713, 1777, 1838, 1860, 1879, 1880, 1891, 2062, 2124, 2153, 2170, 2201, 2218, 2254, 2278, 2328, 2329, 2355, 2384, 2385, 2453, 2586, 2623, 2626, 2633, 2665, 2766, 2778, 2794, 2814, 2818, 2881, 2924, 2938, 2994, 2995, 3017, 3023-3025, 3030, 3032, 3040, 3041, 3045, 3046, 3050, 3051, 3058, 3064-3068, 3070-3072, 3078, 3079, 3081-3083, 3085, 3092, 3095, 3097-3099, 3101, 3113, 3114, 3117, 3125, 3129, 3130, 3133, 3141, 3143-3145, 3147, 3156, 3159, 3176, 3177, 3181-3183, 3198, 3199, 3207-3216, 3220, 3223, 3225-3227, 3229, 3230, 3241-3246, 3248, 3250, 3256, 3257, 3260, 3264, 3265, 3616, 3634, 3635, 3649, 3655, 3666, 3669, 3672, 3685, 3690, 3698, 3709, 3728, 3742, 3761, 3783, 3791, 3799, 3822, 3858, 3867, 3868, 3876, 3940, 3942, 3949, 3953, 3971, 3991, 4004, 4027, 4044, 4060, 4076, 4136, 4178, 4219, 4250, 4311, 4399, 4413, 4453, 4463, 5046, 5066.
Land leveling machinery--1660, 3113, 3242, 3742, 3743, 4044, 4311, 4413, 4463.
Land leveling under water--3072, 3147, 3225, 3241.
Lapland--4916, 4942.
Laws--4, 5, 8, 11-13, 16-18, 20-22, 25-29, 32, 35, 38-40, 42-44, 47, 48, 50, 52-60, 63, 64, 67-70, 72, 74, 77, 83, 88, 90, 93, 94, 98, 101, 102, 115-122, 124-128, 130-136, 142, 144, 149, 153, 221, 321, 1223, 1228, 1238, 1241, 1242, 1293, 1302, 1312, 1315, 1403, 1425, 1450, 1469, 1706, 1953, 2887, 3340, 3341, 3375, 3377, 3865, 4122, 4796, 4819, 5004, 5065, 5181.
Leaching--148, 382, 393, 454, 504, 534, 748, 836, 864, 873, 972, 1051, 1131, 1142, 1625, 1631, 1766, 1767, 1769, 1822, 1868, 1877, 1895, 1914, 1917, 2099, 2166, 2176, 2325, 2338, 2380, 2411, 2412, 2438, 2442, 2457, 2459-2461, 2463, 2464, 2466, 2468, 2469, 2492, 2556, 2596, 2597, 2633, 2645, 2649, 2664, 2668, 2680, 2712, 2715, 2723, 2725, 2744, 2760, 2764, 2789, 2791, 2805, 2823, 2844, 2881, 2894, 2900, 2930-2932, 2953, 2966, 3297, 3494, 3581, 3583, 3584, 3586, 3594, 3597-3600, 3604, 3606-3609, 3617, 3619, 3626, 3627, 3630, 3631, 3637, 3639, 3642, 3644, 3647, 3659, 3661, 3669-3671, 3673, 3675, 3676, 3681, 3693, 3695, 3700-3703, 3708, 3709,
Leaching cont.--3711, 3713-3715, 3719, 3721-3723, 3725-3727, 3730, 3731, 3733, 3736, 3739, 3745, 3747, 3748, 3752, 3754, 3757, 3758, 3764, 3770, 3775, 3780, 3783, 3786, 3789, 3790, 3796, 3803, 3805, 3816, 3823, 3826, 3828, 3830, 3832, 3839, 3849, 3851, 3858, 3859, 3864, 3868, 3871, 3872, 3880-3882, 3889, 3907, 3916, 3917, 3926, 3931, 3933, 3934, 3936, 3943-3945, 3947, 3952, 3957, 3961, 3966, 3971, 3973, 3974, 3977, 3979, 3982, 3988, 3992, 3994, 3995, 3997-4001, 4006, 4015, 4025, 4031, 4036, 4039-4046, 4050, 4056, 4069, 4077, 4079, 4246, 4426.
Levees--106, 1232, 1312, 1424, 1482, 1531, 1574, 1581-1584, 1600, 1846, 2040, 2257, 2331, 2346, 3078, 3097, 3147, 3511, 3728, 3758, 4397, 4540, 4544, 4548, 4561, 4572, 4591, 4608, 4648, 4649, 4658, 4686, 4687, 4719, 4720, 4752, 4768, 4772, 4791, 4792, 4816.
Lined mole drains--1527, 1575, 3281, 3297, 3312-3315, 3325-3328, 3333, 3344-3346, 3387, 3486, 3820, 4114, 4128, 4130, 4149-4152, 4154, 4155, 4164, 4165, 4167, 4171, 4238, 4260, 4304, 4326, 4399.
Louisiana--5, 496, 763-765, 868, 1239, 1601, 2201, 2867, 2994, 3207-3213, 3241, 3264, 4137, 4945.
Lysimeters--369, 386, 387, 395, 399, 404, 423, 430, 457, 458, 487, 499, 504, 544-550, 554, 568, 571, 615, 631, 635-645, 662, 671, 677, 727, 734, 761, 771, 776-778, 848, 859, 870, 875, 877, 881, 884, 885, 887, 910, 912, 930, 963, 967, 992, 1011, 1064, 1075, 1077, 1079, 1082, 1092, 1098, 1101, 1112, 1146, 1149, 1152, 1153, 1155, 1179, 1186, 2442, 2482, 2669, 2861, 2918, 2920, 2974, 3958.

Maine--570, 710, 1024.
Malaya--877, 1490, 5075, 5095.
Manual weed control--4480, 4546, 4552, 4762, 4790.
Maryland--93, 100, 149.
Massachusetts--1397, 4676.
Mechanical weed control--2271, 4090, 4113, 4137, 4191-4193, 4234, 4249, 4316, 4327, 4379-4381, 4385, 4481, 4495, 4514, 4515, 4535, 4536, 4543, 4552, 4554, 4555, 4558, 4560, 4562, 4570, 4612, 4623, 4628, 4629, 4668, 4680, 4685, 4713-4715, 4735, 4737, 4740, 4749, 4750, 4761, 4762, 4765, 4790, 4801.
Mexico--6, 40, 162, 276, 318, 840, 1086, 1609, 1711, 2075, 2076, 2144, 2145, 3094, 3426, 3640, 3855, 3856, 3921, 3969, 3979, 4482, 5178.
Michigan--17, 115, 116, 445, 1957, 2419, 2474, 2530, 2678, 3024, 3115, 3492, 3540, 3566, 4033, 4516, 4842.
Mineral soils--208, 252, 297, 324, 402, 471, 495, 500, 509, 531, 558, 567, 615, 665, 699, 703, 763, 788, 798, 834, 838, 839, 910, 939, 1003, 1687, 1996, 2677, 4299.

Minnesota--82, 577, 649, 1197, 1460, 1507, 1622, 1654-1657, 1891, 2009, 2069, 2220, 3113, 3434, 3541, 3542, 4305, 5076.
Mississippi and Mississippi Valley--24, 524, 727, 1064, 1090, 1287, 1297, 1635, 1732, 1892, 2305, 2491, 3083, 3095, 3211-3213, 3975, 3984, 4512, 4658, 4772.
Missouri and Missouri Valley--683-685, 1067, 1274, 1276, 1298, 1318, 1640, 2060, 2093, 2107, 2122, 2255, 3010, 3011, 3143, 4102, 4597, 4598.
Models--501, 507, 652, 682, 708, 745, 1030, 1224, 1285, 1286, 1289, 1329, 1346, 1412, 1413, 1432, 1435, 1459, 1479, 1487, 1508, 1531, 1551, 1581, 1584, 1591, 1597, 1616, 1617, 1667-1669, 1695, 1730, 1776, 1779, 1784, 1798, 1843-1846, 1854, 1869, 1871, 1978, 2006, 2022, 2029, 2031, 2047, 2126, 2131, 2198, 2224, 2241, 2286, 2301, 2302, 2308, 2318, 2347, 2349, 2361, 2393-2395, 2401-2403, 2413, 2640, 3542, 3549, 3576.
Mole drainage--46, 748, 1677-1679, 1681, 1682, 1701, 1758, 1764, 1776, 1815, 2040, 2083, 2142, 2191, 2211, 2217, 2253, 2266, 2307, 2324, 2475, 2477, 2478, 2479, 2601, 2603, 2605, 2678, 2706, 2719, 2856, 2857, 3069, 3276, 3281, 3290, 3293, 3294, 3296-3298, 3304, 3308, 3312, 3317, 3320, 3325, 3326, 3333-3336, 3338, 3339, 3344-3346, 3349, 3350, 3356, 3361, 3362, 3366, 3371, 3372, 3381, 3387, 3388, 3393, 3402, 3407, 3411-3414, 3419, 3420, 3423, 3427, 3431-3433, 3435, 3440, 3441, 3443-3448, 3450, 3458, 3459, 3461, 3465, 3469, 3480-3483, 3486, 3487, 3491, 3494, 3501, 3531, 3651, 3653, 3654, 3674, 3734, 3770, 3820, 3899, 3941, 3964, 3968, 4003, 4091, 4096, 4101, 4114, 4128, 4129, 4130, 4139, 4143, 4149, 4152, 4154, 4155, 4164, 4165, 4167, 4171, 4189, 4238, 4259-4261, 4293, 4304, 4311, 4323, 4326, 4399, 4423, 4428, 4451, 4467, 4498, 4759, 4844, 4848, 4931, 5020.
Montana--59, 1194, 2494, 3966, 4363, 5045, 5047, 5048.
Mosquitoes--4, 1612, 1729, 1738, 1816, 2107, 2378, 2388, 2429, 2969, 3425, 3698, 3728, 3784, 3865, 3884, 3956, 4072, 4655, 4747, 4783, 4813, 4881, 4929, 5038, 5039, 5040, 5042b, 5048-5053, 5058, 5060, 5062, 5063, 5066, 5069, 5070, 5072-5075, 5080-5083, 5091, 5097.
Moving interface--1208, 1422, 1453, 1564, 2078, 2079, 2111, 2469.

Nebraska--69, 133, 153, 585, 1276, 1310, 1451, 1765, 3117, 3134, 3265, 4176-4178, 4559, 4604, 4605, 4764.
Netherlands--34, 75, 97, 110, 112, 119, 144, 151, 154, 155, 169, 173, 178-181, 203, 231, 240, 245, 271, 272, 278, 285, 296, 304, 310, 314, 327-329, 334, 349, 350, 352, 357, 359, 363, 401, 432, 433, 471, 542, 558, 623, 651, 669, 670, 711, 725, 797, 798, 818, 870, 879, 880, 998, 1004, 1023, 1026, 1112-1114, 1130, 1131, 1148, 1149, 1188, 1249b, 1259, 1264, 1301, 1314, 1342, 1364, 1449, 1470, 1487, 1586, 1664, 1672-1676, 1684, 1712, 1747, 1759, 1761, 1786, 1805, 1853, 1903, 1936-1938, 1950, 1951, 1989-1991, 2003, 2004, 2034, 2112, 2133, 2139, 2163, 2188-2190, 2198, 2204, 2239, 2254, 2263, 2268, 2269, 2284, 2350-2352, 2359, 2368-2377, 2381, 2382, 2385-2387, 2414, 2145, 2480-2482, 2537, 2650, 2661, 2850, 2851, 2874, 2917, 2927, 2935, 2939, 3302, 3322, 3330, 3380-3382, 3389, 3392, 3430, 3488, 3536, 3544, 3551, 3555, 3569, 3650, 3720, 3765, 3875, 4049, 4068, 4126, 4179-4181, 4183, 4230, 4235-4237, 4240, 4268, 4356, 4375, 4405, 4407, 4408, 4421, 4424, 4451, 4528, 4533, 4535, 4536, 4586, 4627, 4689, 4695, 4710-4712, 4740, 4743, 4744, 4769, 4793, 4798-4805, 4833, 4902, 4938, 4939, 4944, 5099-5103, 5105-5111, 5118, 5123, 5126, 5130, 5131, 5134, 5136-5138, 5143, 5144, 5147-5150, 5156, 5159, 5162-5164, 5166, 5168, 5169, 5171, 5173, 5175, 5177, 5179, 5180.
Nevada--1057, 1650, 2039, 2108, 2828, 2918-2920, 3325, 3326, 3713, 3733, 3885, 4076, 4134, 4588, 4699-4701.
New Hampshire--607, 1442.
New Jersey--4, 368, 829, 2113, 2429, 2724, 3415, 3812, 4724, 4747, 4783, 4813, 5051, 5053, 5062, 5083.
New Mexico--12, 55, 608, 1234, 1401, 1453, 1873, 2538, 2780, 2875, 2964, 3522, 3675, 3965, 4576, 4745.
New York--147, 409, 528, 1447, 2320, 2420, 3084, 3191, 3266, 3312, 3501, 4477.
New Zealand--475, 498, 614, 634, 744, 804, 815, 1450, 1602, 1678-1682, 1701, 1764, 1785, 1904, 2083, 2222, 2253, 2855-2857, 2936, 3006, 3007, 3022, 3031, 3032, 3080, 3167, 3261, 3307-3309, 3334, 3427, 3444, 3448, 3509, 3567, 4138, 4143, 4189, 4207, 4291, 4312, 4385, 4386, 4480, 4481, 4497, 4498, 4514, 4546, 4613, 4680, 4734, 4844, 5035.
Nicaragua--3180.
Nomograms and Nomographs--619, 1187, 1355, 1652, 1964, 2004, 2137, 2314, 2315.
North Carolina--16, 25, 568, 1146, 1944, 2435, 2514, 2575, 2582, 2745, 4527, 4838, 4987, 5174.
North Dakota--134, 896, 960, 1213, 1622, 1891, 2586, 2626, 2843, 2844, 3047, 3081, 3082, 4060, 4581, 5076, 5088.
Norway--83, 302, 340, 361, 754, 942, 1608, 1829, 2192, 2548, 2604, 2606, 2720, 2756, 2880, 2885, 2911, 3300, 3301, 3475, 4087-4089, 4182, 4203-4205, 4209, 4224, 4225, 4239, 4250, 4284, 4290, 4417, 4418, 4441, 4442, 4599, 4681, 4754, 4826, 4858, 4859, 4865-4869, 4891, 4892, 4904, 4905, 4991, 4992, 5018.

Ohio--544, 550, 636-640, 647, 761, 772, 1082, 1249a, 1276, 1290, 1292, 1440, 1599, 1831, 1901, 2213-2215, 2218, 2219, 2297, 2301, 2331, 2347, 2473, 2474, 2475, 2924, 2937, 2938, 3024, 3039, 3109, 3196, 3345, 4194, 4345, 5039.

Oklahoma--557, 902, 1294, 1305, 1790, 3195, 3197.

Open ditches--112, 199, 338, 725, 1205, 1206, 1312, 1601, 1618, 1623, 1624, 1629, 1671, 1681, 1696, 1697, 1732, 1733, 1736, 1742, 1759, 1777, 1786, 1805, 1817, 1828, 1835, 1842, 1848, 1853, 1855, 1882, 1884, 1896, 1938, 1971, 1981, 1988, 1989, 1991, 2017, 2018, 2031-2033, 2040, 2045, 2051, 2064, 2100, 2115, 2134, 2136, 2145, 2155-2157, 2171, 2188, 2189, 2192, 2194, 2201, 2206, 2208, 2253, 2255, 2258, 2266, 2267, 2278, 2287, 2289, 2296, 2306, 2321, 2343, 2346, 2365, 2403, 2548, 2613, 2626, 2629, 2677, 2713, 2742, 2745, 2840, 2855, 2886, 2892, 2897, 2935, 2972, 2994, 3027, 3032, 3060, 3069, 3071, 3081, 3156, 3208, 3273, 3299, 3300, 3302, 3307, 3309, 3310, 3323, 3332, 3334, 3349, 3354, 3356, 3358, 3359, 3370-3372, 3411, 3424, 3427, 3428, 3438, 3439, 3444, 3472, 3475, 3488, 3505, 3564, 3577, 3594, 3601, 3625, 3668, 3671, 3706, 3709, 3721, 3734, 3744, 3755, 3771, 3822, 3840, 3865, 3874, 3893, 3927, 3930, 3940, 3941, 3958, 3964, 4027, 4056, 4062, 4076, 4099, 4133, 4134, 4139, 4140, 4144, 4191-4193, 4198, 4207, 4208, 4217, 4227, 4234, 4243, 4251, 4255, 4257, 4266, 4283, 4289, 4295, 4297, 4298, 4303, 4313, 4314, 4332, 4349, 4350, 4357, 4367, 4372-4374, 4386, 4392, 4399, 4404, 4416, 4437, 4452, 4472, 4480, 4483, 4484, 4497, 4504, 4514, 4515, 4536, 4543, 4553, 4575, 4584-4586, 4594, 4595, 4618, 4621, 4624, 4628, 4642, 4655, 4661, 4680, 4683, 4696, 4708, 4712-4714, 4724, 4739, 4758, 4759, 4761, 4765, 4778, 4790, 4813, 4840-4844, 4848, 4854, 4931, 4934, 4945, 4968, 4970, 4971, 4973, 4987, 4996, 5016, 5020, 5022, 5039, 5042b, 5110.

Oregon--125, 283, 631, 967, 1196, 2959, 3221, 3452, 3453, 3622.

Pakistan--368, 385, 747, 1284, 1604, 2071, 2485, 2809, 3502, 3503, 3505, 3594, 3619, 3827, 3872, 3893, 4052, 4470, 4574, 4782, 5093.

Peak flows--129, 1378, 1426, 1494, 1724, 1725, 1773.

Pennsylvania--759, 2647, 2721, 3158, 3191, 5027.

Philippines--459, 567, 900, 1900, 2067, 2097, 2427, 2490, 2773, 3593, 3613, 3614, 3691.

Physical properties of soils--426, 461, 512, 595, 609, 622, 626, 654, 655, 674, 703, 715, 716, 761, 764, 765, 770, 783, 793, 821, 835, 892, 899, 900, 931, 951, 960, 1014, 1025, 1036-1038, 1042, 1043, 1052, 1074, 1128, 1129, 1161, 1176, 1181, 1252, 1565, 1796, 2377, 2428, 2436, 2440, 2446, 2502, 2509, 2515, 2536, 2546, 2573, 2577, 2580, 2662, 2680, 2681, 2701, 2716, 2735, 2750, 2758, 2796, 2814, 2871, 2883, 2898, 2901, 2902, 2904,

Physical properties of soils cont.--2905, 2908, 2929, 2940, 2976, 2977, 2979, 2983, 3778, 4896.

Pipe drainage--1682, 1719, 1758, 1894, 1990, 2003, 2019, 2116, 2129, 2217, 2307, 2367, 2374, 2375, 2387, 2409, 3069, 3280, 3284-3286, 3298, 3301, 3303, 3322, 3328, 3329, 3337, 3347, 3350, 3355, 3357, 3381, 3389, 3392, 3397, 3399, 3421, 3447, 3449, 3451, 3460, 3466, 3467, 3471, 3474, 3489, 3492, 3495, 3963, 4096, 4105, 4122, 4125, 4142, 4153-4156, 4160, 4182, 4184-4186, 4196, 4203, 4205, 4225, 4232, 4235-4237, 4326, 4334, 4361, 4382, 4395, 4407, 4408, 4412, 4417, 4418, 4426, 4441, 4443, 4449, 4453, 4455, 4465, 4498, 4516, 4528, 4681, 4705, 4748.

Plastics--554, 875, 1013, 1575, 1719, 2373-2375, 3297, 3313-3315, 3322, 3325, 3326, 3328, 3333, 3344-3346, 3387, 3486, 3758, 4094, 4096, 4114, 4128, 4130, 4141, 4149, 4154, 4155, 4160, 4164, 4165, 4169, 4171, 4172, 4186, 4196, 4199, 4203-4205, 4225, 4227, 4233, 4235-4238, 4242, 4251-4253, 4265, 4270-4272, 4275, 4278, 4281, 4286, 4294, 4301, 4304, 4325, 4334, 4361-4363, 4398, 4399, 4406-4408, 4411, 4418, 4419, 4440, 4443, 4448-4451, 4454, 4458, 4460, 4465, 4499, 4500, 4513, 4520, 4529, 4534, 4540, 4542, 4544, 4545, 4561, 4563, 4572, 4573, 4581, 4591, 4592, 4617, 4634, 4635, 4638, 4640-4693, 4645, 4648, 4649, 4662, 4677, 4686, 4694, 4716-4720, 4725, 4745, 4776, 4780, 4791, 4817, 5020.

Poland--1, 73, 123, 188, 241, 243, 255, 277, 326, 421, 436, 511, 529-531, 688, 779, 780, 853-857, 888-890, 1073, 1185, 1337, 1361, 1750, 1939, 2066, 2115, 2136, 2137, 2276, 2446, 2448, 2479, 2488, 2577, 2629, 2670, 2686, 2699, 2701, 2707, 2770, 2775, 3269, 3395, 3481, 3621, 3705, 3813, 4011, 4158, 4339, 4748, 4818, 4819, 4847, 4849, 4906, 4949, 4950, 4998, 5001, 5098.

Polders--112, 212, 305, 345, 355, 471, 654, 798, 870, 879, 984, 1003, 1173, 1253, 1254, 1300, 1301, 1589, 1816, 1950, 1951, 1990, 1991, 2133, 2239, 2376, 2398, 2414, 2446, 2662, 2695, 2858, 2874, 2983-2986, 3302, 3392, 3488, 3512, 3533, 3536, 3551, 3555, 3720, 3765, 3915, 4569, 4695, 4816, 5099, 5101, 5102, 5105, 5110, 5111, 5126, 5134, 5143, 5156, 5162, 5168, 5179, 5183.

Portugal--14, 331, 611, 990, 1404, 1472, 1984, 1986-1988, 2177, 2317, 2503, 2512, 3020, 3171, 3201, 3238, 3602, 3616, 3897, 4508, 4683, 4686, 4687.

Pothole drainage--2220, 3021, 5067, 5076.

Precipitation--685, 947, 970, 980, 1010, 1374, 1379, 1415, 1457, 1687, 1719, 1747, 1782, 1784, 1803, 1837, 1886, 1897, 1944, 1975, 2036, 2148, 2208, 2229, 2233, 2368, 2390, 2391, 2395, 2415, 2495, 2554, 2775, 2844, 3725, 3947.

Puerto Rico--274, 431, 2478, 2968, 3161, 3586, 3665, 4019.

Radioactive and fluorescent tracers--403, 627, 642, 691, 714, 749, 796, 851, 893, 1200, 1234, 1244, 1261, 1263, 1310, 1316, 1321, 1322, 1334, 1384, 1397, 1569, 1597, 1793, 2167, 3584.
Reclamation--15, 34, 86, 113, 118, 140, 164, 165, 201, 234, 238, 269, 321, 359, 381, 754, 781, 821, 978, 1134, 1249b, 1360, 1405, 1408, 1410, 1439, 1478, 1499, 1549, 1566, 1604, 1619, 1624, 1721, 1726, 1742, 1781, 1815, 1816, 1916, 1950, 1951, 1994, 2062, 2074, 2084, 2141, 2181, 2266, 2269, 2325, 2338, 2346, 2433, 2512, 2557, 2572, 2606, 2695, 2801, 2881, 2934, 2942, 2990, 2993, 3160, 3267, 3279, 3297, 3412, 3428, 3439, 3488, 3499, 3506, 3514, 3588, 3589, 3596, 3600, 3629, 3637, 3643, 3664, 3669, 3703, 3717, 3730, 3738, 3796, 3808, 3811, 3822, 3824, 3874, 3880, 3890-3892, 3900, 3917, 3948, 3952, 3955, 3960, 3976, 4001, 4005, 4007, 4009, 4029, 4042, 4054, 4069, 4077, 4115, 4118, 4258, 4268, 4277, 4310, 4319, 4328, 4331, 4352, 4365, 4389, 4400, 4420, 4421, 4431, 4432, 4435, 4493, 4505, 4693, 4823, 4824, 4832, 4834, 4838, 4841, 4843, 4845, 4846, 4855, 4856, 4860, 4874, 4875, 4878, 4879, 4885, 4886, 4891, 4897, 4899, 4905, 4910, 4911, 4917-4919, 4927, 4930, 4935, 4939-4941, 4946, 5000, 5002, 5037, 5074, 5096, 5099, 5107, 5112, 5114, 5115, 5125, 5131, 5139, 5142, 5144-5146, 5158, 5160, 5165, 5168, 5169, 5173, 5175.
Recreational areas--118, 1206, 1207, 1451, 1489, 1491, 1913.
Relief drains--1912, 2278, 2333, 2896, 3770.
Reservoirs and ponds--1209, 1210, 1217, 1279, 1298, 1336, 1348, 1357, 1369, 1373, 1468, 1475, 1497, 1508, 1512, 1527-1529, 1535, 1538, 1545, 1585, 2196, 2593, 2819, 2896, 3951, 4066, 4094, 4150, 4387, 4397, 4411, 4475, 4496, 4520, 4524, 4525, 4529, 4563, 4597, 4598, 4631-4636, 4639-4641, 4644, 4645, 4677, 4703, 4725, 4732, 4761, 4795, 4797, 5034, 5145.
Road drainage--1605, 1814, 1969, 2097, 2272, 2306, 3077, 4142, 4188, 4300, 4369, 4903, 4928, 4962, 5008, 5018, 5023.
Rumania--92, 106, 215, 336, 383, 464, 481, 605, 606, 882, 1219, 1878, 2103, 2152, 2892, 2997, 3000, 3048, 3049, 3121, 3136, 3164, 3165, 3168, 3237, 3251, 3507, 3574, 3658, 3754, 3842-3845, 3860, 3906, 3907, 3910, 3983, 4111, 4223, 4476, 5129.

Saline and sodic soils--64, 148, 366, 381, 382, 385, 393, 394, 411, 431, 453-455, 456, 464, 478, 483, 484, 489, 510, 523, 532, 534, 535, 555, 559, 560, 573, 576, 579, 581, 595, 633, 650, 666-668, 678, 698, 705, 728, 742, 750, 752, 756, 805, 807, 821, 836, 840, 849, 860, 864, 873, 895, 898, 899, 902, 903, 913, 918, 960, 966, 972, 978, 996, 1002, 1028, 1033, 1034, 1050, 1132-1136, 1143, 1157, 1158, 1175, 1179, 1212, 1213, 1253, 1254, 1347, 1626, 1643, 1769, 1781, 1816, 1895, 1914, 1917, 1940, 1994, 2099, 2109, 2144, 2161, 2176, 2325, 2338, 2345, 2346, 2353, 2441, 2456, 2462, 2487, 2502, 2509, 2524, 2533, 2538, 2556, 2557, 2588, 2591, 2594, 2596, 2628, 2633, 2642, 2644, 2645, 2654, 2663, 2664, 2667, 2669, 2703, 2707, 2722, 2723, 2738, 2761, 2764, 2810, 2823-2825, 2835, 2842, 2875, 2910, 2932, 2948, 2957, 3069, 3411, 3474, 3514, 3582, 3585, 3586, 3589-3592, 3594, 3597, 3598, 3602-3604, 3606-3612, 3615, 3617, 3619, 3620, 3624-3627, 3630-3632, 3637-3639, 3642-3645, 3647, 3655-3657, 3659-3661, 3664, 3665, 3668-3670, 3673-3676, 3678-3681, 3683, 3684, 3686-3688, 3692-3695, 3697, 3700-3703, 3709, 3711, 3713, 3715-3717, 3721-3723, 3725-3727, 3730, 3731, 3733, 3739, 3745, 3747, 3748, 3750-3752, 3754, 3755, 3762-3764, 3767, 3769, 3773, 3775, 3777, 3780, 3783, 3784, 3796, 3800, 3802-3808, 3810, 3816, 3817, 3819, 3823-3832, 3835, 3837, 3842-3845, 3850, 3851, 3856, 3858-2860, 3863, 3866, 3868-3871, 3874, 3875, 3878, 3880, 3882, 3886, 3889, 3895, 3900, 3902-3904, 3906, 3907, 3910, 3912, 3916-3919, 3921, 3925, 3931-3934, 3936-3939, 3943, 3944, 3946-3948, 3952, 3955, 3959-3962, 3966, 3967, 3969, 3972-3974, 3976-3979, 3982, 3983, 3988, 3990, 3992, 3994, 3995, 3998-4001, 4005-4010, 4013-4015, 4017, 4018, 4021, 4022, 4029-4031, 4035-4039, 4042, 4045, 4046, 4048, 4052, 4056, 4059, 4063, 4067, 4069, 4073, 4077-4079, 4081, 4426, 4589.
Saline and sodic water--384, 513, 643, 676, 823, 840, 841, 849, 913, 982, 1136, 1158, 1159, 1191, 1212, 1213, 1249b, 1284, 1323, 1347, 1362, 1373, 1422, 1430, 1435, 1445, 1453, 1564, 1677, 1706, 1757, 1765, 1797, 1868, 1895, 2001, 2109, 2291, 2292, 2430, 2437, 2438, 2442, 2449, 2458, 2461-2464, 2466, 2483, 2485-2487, 2492, 2507, 2511, 2515, 2520-2524, 2527, 2532, 2533, 2535, 2536, 2541, 2544, 2554-2556, 2567-2569, 2573, 2596-2598, 2607, 2611, 2613, 2624, 2628, 2644, 2645, 2649, 2654, 2656, 2667-2669, 2685, 2694, 2703, 2709, 2715, 2725-2730, 2732-2734, 2754, 2763, 2766, 2780, 2782, 2788, 2790, 2794, 2805, 2815, 2825, 2835, 2844, 2881, 2890, 2893, 2897, 2910, 2930, 2931, 2953, 2963-2967, 2969, 2970, 2983, 3592, 3649, 3708, 3710, 3752, 3865, 3871, 3882, 3883. 3885, 3952, 3960, 3999, 4034, 4070.
Salt tolerance--2449, 2457-2460, 2464, 2467, 2469, 2533, 2538, 2542, 2544, 2563, 2567-2569, 2612, 2696, 2737, 2780, 2789, 2790, 2792, 2812, 2815, 2953, 2967, 3755.
Saturated flow--831, 1306, 2179.
Scandinavia--247, 2658.
Sediment density--773, 774, 1937, 2071, 2072.

Sedimentation--64, 327, 773, 774, 907, 1197, 1266, 1272, 1293, 1298, 1299, 1310, 1325, 1326, 1357, 1358, 1373, 1389, 1401, 1462-1464, 1542, 1737, 1752, 1780, 1834, 1897, 1937, 1938, 1943, 1946, 2015, 2071, 2072, 2245, 2352, 3378, 3391, 3467, 3500, 3888, 4064, 4670, 4737.

Seepage--401, 492, 509, 610, 713, 934-936, 981, 1124, 1162-1164, 1253-1255, 1327, 1373, 1407, 1445, 1475, 1500, 1503, 1508, 1509, 1511-1515, 1519, 1524, 1525, 1527-1535, 1537, 1538, 1540, 1545, 1550-1552, 1554, 1562, 1564, 1568-1570, 1573, 1575, 1579-1587, 1599, 1604, 1634, 1670, 1757, 1815, 1864, 1866, 1911, 1973-1976, 2051, 2098, 2125, 2176, 2190, 2205, 2283, 2295, 2335. 2359. 2361, 2484, 2496, 2896, 3371, 3372, 3531, 3546, 3560, 3577, 3595, 3710, 3778, 3814, 3940, 3951, 4086, 4148, 4150, 4210, 4317, 4358, 4411, 4461, 4470, 4489, 4494, 4504, 4509, 4511, 4512, 4521, 4522, 4525, 4529, 4530, 4549, 4557, 4559, 4577, 4587, 4589, 4601, 4603-4605, 4625, 4631, 4632, 4634-4636, 4639-4641, 4644, 4645, 4654, 4658, 4677, 4698, 4703, 4725, 4727-4733, 4738, 4772, 4776, 4782, 4795, 4797, 4798, 5063.

Seepage control--509, 701, 1124, 1164, 1445, 1634, 1670, 1729, 1760, 1984, 2001, 2039, 2096, 2114, 2121, 2176, 2205, 2319, 2896, 3372, 3546, 3577, 3622, 3666, 3778, 3813, 3890, 3940, 3951, 3997, 4028, 4042, 4072, 4094, 4095, 4109-4112, 4116, 4141, 4146-4148, 4150, 4159, 4173, 4210, 4223, 4242, 4251-4253, 4263, 4278, 4281, 4294, 4317, 4320, 4325, 4326, 4335, 4343, 4346, 4358, 4363, 4368, 4387, 4393, 4394, 4411, 4419, 4439, 4440, 4447, 4450, 4453, 4455-4457, 4460, 4461, 4468, 4473-4476, 4489, 4491, 4494, 4496, 4497, 4500-4502, 4505, 4508, 4509, 4511, 4512, 4520, 4522-4526, 4529, 4532, 4534, 4537, 4539, 4542, 4549, 4556, 4557, 4559, 4563-4565, 4573-4577, 4581, 4588, 4592, 4597, 4598, 4601, 4603-4605, 4608, 4611, 4614, 4615, 4617, 4630-4645, 4651-4654, 4656, 4661, 4667, 4671, 4672, 4677, 4678, 4682, 4688, 4698-4701, 4703, 4704, 4709, 4716-4718, 4725, 4727-4733, 4735, 4736, 4738, 4751, 4753, 4771, 4772, 4776, 4780, 4782, 4786, 4788, 4792, 4795, 4797, 4806-4812, 4814, 4817, 4820, 4821.

Semiarid regions--2667, 2679, 3830, 3834.

Soil aeration--370, 440, 505, 506, 514, 686, 745, 746, 788, 1057, 1145, 1924, 2377, 2505, 2576, 2608, 2648, 2713, 2768, 2779, 2783, 2895, 2914, 2974, 2975.

Soil and water conservation--172, 208, 220, 301, 332, 1293, 1304, 1306, 1444, 1445, 1530, 1534, 1575, 1755, 2996, 3002, 3060, 3864, 4028, 5050, 5036.

Soil Biology--2443, 2539, 2610, 2634, 2646, 2650, 2692, 2771, 2786, 2787, 2810, 2875, 2884, 2951, 2972, 2990, 4852, 5073.

Soil Chemistry--381, 385, 393, 394, 408, 453, 455, 495, 497, 511, 520, 523, 535, 536, 576, 595, 612, 646-648, 650, 654, 655, 666, 670, 693-695, 732, 756, 757, 761, 770, 807, 808, 821, 823, 840, 868, 877, 884, 892, 899, 900, 902, 918, 929, 931, 944, 945, 951, 952, 957, 960, 984, 991, 1014, 1036, 1037, 1042-1044, 1050, 1052, 1074, 1080, 1081, 1136, 1137, 1142, 1160, 1174, 1176, 1323, 1556, 1597, 1631, 1767, 1796, 1797, 2167, 2365, 2428, 2433, 2440-2442, 2446, 2467, 2468, 2490, 2493, 2509, 2511, 2527, 2546, 2547, 2554, 2573, 2599, 2610, 2624, 2646, 2647, 2663, 2664, 2666, 2680, 2681, 2683, 2685, 2701, 2732, 2735, 2744, 2750, 2758, 2804, 2825, 2843, 2849, 2852, 2883, 2901, 2902, 2904, 2905, 2908, 2917, 2921, 2940, 2953, 2961, 2962, 2964-2966, 2977, 2979, 2983, 2984, 3584, 3642, 3661, 3665, 3708, 3778, 3918, 3998, 4063, 4896, 5084.

Soil density--372, 415, 427, 475, 515, 591, 629, 672, 714, 781, 789, 804, 867, 876, 877, 893, 904, 907, 965, 1035, 1055b, 1087, 1091, 1102, 1118, 1144, 1299, 1357, 1358, 1541, 2713, 2741, 2878, 3592.

Soil fertility--268, 471, 2565, 2585, 2623, 2802, 2859, 4871.

Soil formation--560, 607, 612, 694, 759, 798, 820, 823, 838, 856, 908, 937, 993-997, 1033, 1073, 1074, 1126, 1182, 1188, 1253, 1254, 1347, 1475, 1766, 1994, 2291, 2632, 2712, 2761, 2817, 2980, 3597, 3606, 3617, 3619, 3620, 3657, 3668, 3694, 3747, 3790, 3807, 3824, 3842-3845, 3903, 3907, 3912, 3991, 4057-4059, 4934, 4958.

Soil Genesis and Classification--64, 79, 208, 324, 366, 378, 380, 382, 384, 385, 391, 393, 394, 397, 407, 409, 410, 411, 419, 421, 425, 431-433, 454-456, 459, 461, 465, 475, 478, 482, 483, 486, 489, 490, 494, 496, 497, 500, 505, 510, 516, 518-520, 522, 523, 530-532, 536, 537, 541, 542, 546, 550, 551, 555, 557-560, 562, 563, 569, 570, 573, 576-579, 581, 587, 602, 604, 605, 607, 608, 612, 613, 615, 617, 621, 633, 634, 646, 647, 649, 651, 653-655, 663, 665-669, 673, 678, 682-685, 688, 691, 693-698, 702, 710, 711, 717, 725, 728, 730-733, 735, 736, 739, 742, 744, 747-750, 752, 754-756, 758, 759, 762, 763, 765, 767, 770, 780, 782, 788, 794, 795, 797-799, 807, 812, 815-817, 820, 826, 827, 832, 837, 838, 843-846, 849, 850, 853-857, 860, 862, 864, 865, 868, 872-874, 879, 880, 882, 884, 886, 891, 892, 894-900, 902, 903, 908, 911, 926-928, 931, 933, 934, 939-941, 946, 950, 952, 953, 955-957, 959-961, 965, 966, 971, 972, 974, 978, 981, 984, 985, 991, 993-999, 1002-1004, 1009, 1012, 1014, 1017, 1028, 1033, 1034, 1036-1039, 1042, 1043, 1050-1053, 1060, 1061, 1073, 1074, 1076, 1085, 1090, 1106, 1107, 1110, 1112, 1123, 1126, 1128, 1130, 1132-1137, 1143, 1147, 1157, 1159, 1161, 1165, 1172-1174, 1180, 1182, 1185, 1188, 1212, 1213, 1249b, 1252, 1254, 1307, 1337, 1347, 1445, 1475, 1510, 1519, 1556, 1561, 1573, 1626, 1630-1632, 1643, 1661, 1666, 1742, 1751, 1753, 1758, 1766, 1767, 1769, 1781, 1799, 1800, 1812, 1815, 1816, 1827, Soil Genesis and Classification cont.--1831, 1844, 1854, 1870, 1881, 1895, 1905, 1914, 1917, 1921, 1922, 1940, 1946-1948, 1973, 1981, 1991, 1994-1996, 2020, 2050, 2062, 2074, 2083, 2085, 2099, 2109, 2117-2119, 2131, 2133, 2134, 2141, 2144, 2161, 2168, 2191, 2207, 2218, 2226, 2236, 2255, 2256, 2259, 2272, 2279, 2282, 2291, 2293, 2298, 2302, 2317, 2319, 2320, 2325, 2327, 2333, 2338, 2345, 2346, 2353, 2382, 2389, 2393, 2397, 2401, 2427, 2431, 2434, 2436, 2441, 2446, 2447, 2452, 2453, 2456, 2462-2465, 2489, 2490, 2502, 2504, 2509, 2511, 2512, 2524, 2530, 2533, 2538, 2556, 2557, 2561, 2577, 2588, 2594, 2596, 2609, 2610, 2624, 2628, 2632, 2633, 2642, 2644, 2647, 2649, 2650, 2654, 2663, 2664, 2666, 2667, 2669, 2677, 2678, 2680, 2681, 2701, 2707, 2712, 2716, 2721, 2722, 2723, 2726, 2738, 2761, 2775, 2784, 2788, 2791, 2801, 2808, 2810, 2817, 2823-2825, 2835, 2842, 2843, 2849, 2854, 2864, 2867, 2873, 2875, 2879, 2881, 2883, 2896, 2898, 2903, 2905-2907, 2910, 2921, 2922, 2924, 2928, 2932, 2939, 2948, 2954, 2957, 2976, 2977, 2979, 2980, 2983-2986, 3018, 3069, 3085, 3092, 3093, 3099, 3110-3112, 3146, 3191, 3202, 3211-3213, 3216, 3225, 3229, 3233, 3234, 3247, 3254, 3255, 3287, 3295, 3303, 3308, 3319, 3324, 3333, 3351, 3381, 3390, 3403, 3412, 3413, 3415, 3427, 3430, 3448, 3465, 3474, 3482, 3483, 3496, 3514, 3581, 3582, 3585, 3586, 3589-3592, 3594, 3597, 3598, 3602-3604, 3606-3612, 3615, 3617, 3619, 3620, 3624-3627, 3630-3632, 3637-3639, 3642-3645, 3647, 3653, 3655-3657, 3659-3661, 3664, 3665, 3668-3670, 3673-3676, 3678-3681, 3683, 3684, 3686-3688, 3692-3695, 3697, 3700-3703, 3709, 3711, 3713, 3715-3717, 3721-3723, 3725-3727, 3730-3731, 3733, 3736, 3739, 3745, 3747, 3748, 3750-3752, 3754, 3755, 3762-3764, 3766, 3767, 3769, 3773, 3775, 3777, 3778, 3780, 3783, 3784, 3796, 3800, 3802, 3803-3808, 3810, 3816, 3817, 3819, 3821, 3823-3832, 3835, 3837, 3842-3845, 3850, 3851, 3853, 3856, 3858-3860, 3863, 3866, 3868-3871, 3874, 3875, 3878, 3880, 3882-3884, 3886, 3889, 3895, 3900, 3902-3904, 3906, 3907, 3910, 3912, 3916-3919, 3921, 3925, 3931-3934, 3936-3939, 3943, 3944, 3946-3948, 3952, 3955, 3959-3962, 3966, 3967, 3969, 3970, 3972-3974, 3976-3979, 3982, 3983, 3988, 3990-3992, 3994, 3995, 3998-4001, 4005-4010, 4013-4015, 4017, 4018, 4021, 4022, 4027, 4031, 4035-4039, 4042, 4045, 4046, 4048, 4052, 4055-4059, 4063, 4067, 4069, 4073, 4077-4079, 4081, 4282, 4426, 4551, 4589, 4597, 4598, 4604, 4605, 4668, 4777, 4876, 4880, 4888, 4934, 4958, 5099.

Soil groups--1028, 1060, 1061, 1188, 1379, 1519, 1632, 1666, 1788a, 1799, 1800, 1831, 1844, 1854, 1973, 1995, 2020, 2055, 2074, 2083, 2117, 2146, 2168, 2216, 2246, 2255, 2256, 2288, 2293, 2302, 2319, 2327, 2393, 2490, 2667, 2681, 2684, 2724, 2842, 2845-2847, 2849, 2905, 2985, 2986, 3092, 3093, 3112, 3146, 3191, 3203, 3211, 3216, 3225, 3254, 3319, 3390, 3403, 3465, 3482, 3483, 3496, 3653, 3692, 3762, 3766, 3859, 3970, 4017, 4018, 4027, 4056, 4284, 4551, 4589, 4777, 4880, 4888.

Soil mapping--569, 711, 725, 730, 747, 750, 797, 855, 928, 966, 999, 1001, 1004, 1008, 1113, 1138, 1140, 1144, 1166, 1751, 1815, 2062, 3784.

Soil management--163, 191, 381, 667, 675, 730, 750, 788, 853, 1002, 1292, 2471, 2559, 2767, 3025, 3186, 3309, 3586, 3626, 3642, 3660, 3698, 3713, 3722, 3874, 3900, 3952, 3994, 4022, 4067, 4785, 4834, 4835, 4849.

Soil moisture conductivity--401, 402, 405, 414-416, 434, 438, 439, 441-444, 473, 501, 523, 524, 531, 538-540, 562, 584, 588, 598, 602, 618, 620, 643, 665, 681, 682, 689, 692, 708, 713, 717, 740, 768, 769, 791, 792, 805, 826, 829-831, 838, 841, 888, 904-906, 913, 917, 947, 967, 969, 975, 976, 982, 1000, 1006, 1010, 1020, 1026, 1045-1048, 1116, 1122, 1124, 1150, 1151, 1171, 1175, 1382, 1498, 1508, 1510, 1514, 1517, 1520, 1554, 1584, 1666, 1720, 1781, 1819, 1854, 1903, 1924, 1934, 2017, 2052, 2182, 2279, 2341, 2403, 2408, 2929, 2959, 3474, 3478, 4425.

Soil moisture content--365, 367, 368, 371, 372, 374-377, 379, 383, 388-390, 397, 400, 403, 405, 406, 409, 412, 413, 415, 422, 424-428, 432, 445-451, 464, 466-470, 472-474, 476, 477, 479-481, 484, 485, 488, 493, 498, 500, 502, 512-515, 517, 521, 526, 527, 529, 531, 533, 534, 543, 546, 547, 549, 552, 557, 563-367, 570, 574, 579, 582, 583, 585, 586, 589, 592-594, 598, 600, 610, 611, 618-620, 622-625, 631, 641, 642, 644, 648, 652, 653, 656-661, 663, 672, 682, 683, 690, 696, 699, 704, 705, 712, 714, 716, 719-723, 726, 729, 731, 732, 738, 743, 748, 751, 763-765, 771-776, 779, 781, 784-787, 790-806, 808-810, 814, 816, 818, 819, 822, 824-826, 828, 829, 833, 836, 837, 839, 842, 845, 846, 852, 858, 861, 866, 871, 874, 876, 878, 883, 888-891, 893, 901, 907, 909, 914-917, 919-926, 937-942, 944, 947, 964, 965, 973, 979, 980, 986-988, 990, 1007, 1008, 1015, 1016, 1018-1024, 1027, 1041, 1053, 1054, 1055b, 1058, 1059, 1062, 1063, 1066, 1068-1072, 1078, 1083, 1087-1090, 1093-1097, 1099-1104, 1108, 1109, 1113, 1117-1120, 1127, 1139, 1140, 1144, 1148, 1154, 1161, 1166-1170, 1177, 1181, 1183, 1184, 1187, 1261, 1306, 1382, 1415, 1531, 1661, 1663, 1677, 1782, 1793, 1820, 1867, 1893, 1904, 1934, 2305, 2577, 2768, 2940, 4093, 4100, 4425.

Soil moisture diffusity--462, 463, 598, 602, 679, 680, 718, 737, 782, 917, 1792, 1820, 1869, 1958, 1959, 2173, 2224, 2974.

Soil moisture movement--373, 409, 418, 469, 492, 508, 516, 525, 527, 528, 545, 546, 561, 580, 596, 597, 599, 600, 606, 620, 630, 656, 659, 675, 679, 682, 691, 706, 707, 709, 718, 724, 741, 760, 808, 834, 835, 905, 914, 916, 932, 933, 937, 938, Soil moisture movement cont.--945, 969, 981, 1029, 1030, 1055a, 1056, 1057, 1060, 1061, 1079, 1111, 1112, 1147, 1156, 1306, 1384, 1484, 1516, 1517, 1537, 1584, 1650, 1666, 1716, 1718, 1758, 1818, 1863, 1864, 1870, 1871, 1903, 1925, 1926, 2050, 2052, 2110, 2128, 2173, 2223, 2224, 2279, 2281, 2351, 2410, 2603, 2808, 2968, 3415, 3478, 3547, 3618, 3919, 4425.

Soil moisture potential--390, 414, 659, 681, 921, 1057, 1893, 2184, 2576.

Soil Physics--308, 365, 367-377, 379, 381, 383, 386-392, 395-409, 412-418, 420, 422-430, 434-452, 457-464, 466-477, 479-481, 484, 485, 487, 488, 491-493, 498, 499, 501-509, 512-517, 521-529, 531, 533-536, 538-540, 543-550, 552-554, 556, 561-568, 570-572, 574, 575, 578, 580, 582-586, 588-603, 606, 609-611, 614-620, 622-632, 634-646, 648, 652, 654-665, 671, 672, 674-677, 679-687, 689-692, 695, 699-701, 703-709, 712-724, 726, 727, 729, 731, 732, 734, 736-738, 740, 741, 743, 745, 746, 749, 751, 758, 760, 761, 763-766, 768-779, 781, 783-793, 795, 796, 800-806, 809-811, 813, 814, 818, 819, 821, 822, 824-826, 828, 830, 831, 833-839, 842, 845, 847, 848, 851, 852, 858, 859, 861, 863, 864, 868-871, 875-878, 883-885, 887-890, 892, 893, 896, 897, 899, 901, 904-910, 912-917, 919-926, 930-938, 940-945, 947-949, 951, 952, 954, 957, 960, 962-965, 968-970, 973, 975-977, 979, 981-983, 986-990, 992, 998, 1000, 1005-1008, 1010, 1011, 1013-1016, 1018-1027, 1029-1032, 1035-1038, 1040-1050, 1052-1072, 1074, 1075, 1077-1079, 1082, 1083, 1086-1105, 1108-1120, 1122, 1124, 1125, 1127-1131, 1138-1140, 1141, 1144-1154, 1156, 1161-1164, 1166-1171, 1175-1179, 1181, 1183, 1184, 1186, 1187, 1200, 1219, 1234, 1244, 1252, 1261, 1263, 1299, 1306, 1310, 1316, 1321, 1322, 1334, 1346, 1357, 1358, 1371, 1382, 1384, 1397, 1419, 1445, 1498, 1508-1517, 1520, 1524, 1537, 1541, 1554, 1556, 1565, 1670, 1677, 1693-1694, 1720, 1751, 1753, 1758, 1792, 1796, 1811-1820, 1832, 1833, 1840, 1841, 1861, 1863, 1864, 1867, 1869-1871, 1893, 1903, 1904, 1924-1926, 1934, 1937, 1958, 1959, 1968, 1971, 1972, 1999, 2030, 2052, 2055, 2110, 2121, 2126, 2128, 2131, 2133, 2173, 2179, 2180, 2182, 2184, 2188, 2203, 2207, 2223, 2224, 2246, 2279, 2282-2284, 2288, 2295, 2297, 2299, 2301, 2305, 2341, 2351, 2357, 2368, 2369, 2377, 2402, 2403, 2408, 2410, 2428, 2436, 2439, 2440, 2442, 2446, 2455, 2467, 2476, 2486, 2489, 2502, 2509, 2511, 2515, 2535, 2536, 2546, 2547, 2573, 2574, 2576, 2577, 2580, 2592, 2599, 2603, 2632, 2662, 2669, 2677, 2680, 2681, 2701, 2716, 2735, 2736, 2741, 2750, 2758, 2769, 2790, 2796, 2801, 2806, 2808, 2814, 2815, 2821, 2822, 2859, 2861, 2871, 2874, 2878, 2883, 2893, 2895, 2898, 2901, 2902, 2904, 2905, 2908, 2914, 2918, 2929, 2940, 2968, 2974, 2975, 2976, 2977, 2979, 2983, 2990, 3110, 3203, 3296, 3415, 3474, 3478, 3547, 3618, 3643-3665, 3708, 3778, 3821, 3919, 3958, 3959, 4049, 4063, 4074, 4086, 4093, 4100, 4425, 4551, 4614, 4698, 4896.

Soil porosity--473, 716, 889, 1145, 1924, 2299.

Soil profiles--600, 826, 836, 845, 896, 900, 933, 1003, 1004, 1044, 1050, 1114, 1165, 1518, 2279, 2722, 2808, 2928.

Soil sealants and stabilizers--509, 614, 701, 1514, 1527, 1529, 1553, 1567, 1568, 1575, 2039, 4147, 4150, 4326, 4368, 4471, 4475, 4489, 4496, 4502, 4517, 4521-4526, 4532, 4538, 4548, 4550, 4556, 4559, 4582, 4597, 4598, 4601, 4603-4605, 4611, 4625, 4631-4633, 4638, 4647, 4699-4701, 4703, 4725, 4727-4733, 4738, 4751, 4753, 4771, 4776, 4809-4812, 4814, 4817, 4820.

Soil structure--417, 703, 715, 908, 915, 920, 1061, 1084, 1131, 2440, 2475, 2577, 2580, 2592, 2768, 2815, 2821, 2822, 2859, 2874, 3701, 3821.

Soil temperature--424, 528, 584, 751, 1869, 2439, 2797, 2991.

Soil texture--208, 252, 297, 324, 402, 471, 495, 500, 509, 531, 558, 567, 615, 665, 699, 703, 763, 788, 798, 834, 838, 839, 910, 939, 1003, 1041, 1130, 1188, 1307, 1548, 1561, 1573, 1611, 1631, 1705, 1731, 1739, 1767, 1812, 1827, 1870, 1921, 1946-1948, 2083, 2191, 2218, 2236, 2298, 2317, 2333, 2382, 2397, 2399, 2434, 2446, 2504, 2561, 2644, 2678, 2707, 2716, 2724, 2775, 2844, 2854, 2879, 2907, 2922, 2924, 2939, 2976, 2977, 3092, 3093, 3233, 3247, 3287, 3288, 3308, 3324, 3351, 3383, 3413, 3427, 3430, 3448, 3482, 3483, 3496, 3653, 3715, 3948, 4512, 4668, 4700, 4727-4730, 4811.

Soil types--79, 391, 393, 397, 407, 409, 433, 496, 505, 510, 516, 550, 557, 562, 569, 602, 604, 617, 647, 654, 655, 663, 665, 666, 682-684, 710, 717, 725, 726, 731, 732, 748, 763, 767, 794, 795, 799, 815, 837, 857, 868, 874, 895, 926, 953, 961, 965, 966, 967, 980, 998, 999, 1002-1004, 1039, 1053, 1076, 1085, 1147, 1174, 1252, 1477, 1742, 1753, 1767, 1905, 1922, 1947, 2133, 2134, 2176, 2207, 2213, 2259, 2282, 2320, 2377, 2389, 2446, 2452, 2453, 2474, 2475, 2502, 2512, 2530, 2610, 2628, 2644, 2666, 2678, 2722, 2726, 2727, 2764, 2784, 2814, 2864, 2898, 2906, 2921, 2954, 2959, 3018, 3099, 3110, 3111, 3202, 3229, 3233, 3234, 3255, 3298, 3303, 3308, 3319, 3333, 3415, 3450, 3627, 3653, 3884, 4055, 4597, 4598, 4604, 4605, 4876.

Soils and vegetation--1203, 1790, 2219, 2230, 2270, 2271, 2570, 2593, 2630, 2631, 2819, 2820.

South America--35, 206, 213, 472, 911, 1603, 1611, 1634, 1648, 1849, 2085, 2197, 2434, 2753, 3397, 3682, 3706, 3915, 3986, 3988, 4373, 4486, 4625, 5133.

South Carolina--755, 1896, 3130, 3146, 3148, 3486, 3495, 3578, 5174.

South Dakota--39, 897, 1132, 1133, 1485, 1580, 2930, 5076, 5077.

Spain--81, 305, 343, 595, 1615, 1782, 2059, 2835, 2923, 2999, 3005, 3037, 3038, 3186,

Spain cont.--3627, 3671, 3684, 3746, 3749, 3863, 3922, 3976, 4370, 4509, 4589, 4821.
Statistics--9, 65, 66, 100, 107, 137, 221, 337, 338, 927, 1106, 1466, 1650, 1957, 2383, 2420, 2435, 2498, 3071, 3079, 3159, 3226, 3367, 3379, 3415, 3473, 3474, 3540, 3566, 3768, 4168, 4599, 4600, 4916, 4969.
Storm runoff and floods--12, 39, 118, 143, 153, 159, 284, 974, 1192-1199, 1202-1205, 1207, 1209-1211, 1214, 1215, 1220-1223, 1227, 1232, 1235, 1236, 1239, 1242, 1245-1247, 1249a, 1249b, 1251, 1258-1260, 1265, 1266, 1269, 1271, 1274, 1277, 1279, 1280, 1284-1288, 1290, 1291, 1293, 1294, 1296-1298, 1300-1302, 1304, 1305, 1308, 1309, 1311-1313, 1317-1319, 1328-1330, 1332, 1335, 1336, 1339, 1341, 1342, 1348-1351, 1359-1361, 1364-1367, 1369, 1372-1377, 1380, 1381, 1383, 1386, 1388-1890, 1392, 1394, 1395, 1398-1405, 1408-1411, 1414, 1416-1418, 1420, 1421, 1425-1428, 1434, 1435, 1437-1443, 1447, 1448, 1450-1452, 1457, 1460, 1465-1467, 1470-1478, 1483, 1486, 1488-1493, 1496, 1559, 1560, 1562, 1618, 1622, 1642, 1647, 1747, 1775, 1793, 1883, 1892, 1958-1960, 2006, 2016, 2040, 2074, 2084, 2111, 2120, 2169, 2171, 2181, 2242, 2250, 2261, 2305, 2322, 2355, 2416, 2570, 2571, 2679, 2819, 2956, 3006, 3105, 3116, 3137, 3232, 3270, 3271, 3498, 3511, 3562, 3682, 3834, 3980, 3981, 4412, 4477, 4501, 4579, 5065, 5067, 5145, 5149, 5177.
Subsidence--520, 646, 725, 736, 1406, 1860, 2078, 2079, 2136, 2137, 2367, 2424, 2425, 2428, 2432, 2451, 2529, 2530, 2558, 2601, 2604, 2610, 2657, 2658, 2720, 2746, 2772, 2803, 2867, 2880, 2885, 2888, 2889, 2913, 3760, 4003, 4033, 4358, 4490, 4557, 4653, 4660, 4666, 4839, 4936.
Subsoiling--46, 2253, 2307, 2528, 3129, 3363, 3938, 4067, 4218, 4697.
Surface field ditches--3085, 3097, 3103, 3145, 3149, 3183, 3206, 3208, 3243.
Sweden--3, 31, 41, 101, 106, 166, 205, 227, 228, 270, 287, 512, 513, 622, 626, 806, 828, 1263, 1334, 1393, 1645, 1688, 1802, 1855-1859, 1862, 2425, 2426, 2550, 2551, 2558, 2584, 2592, 2595, 2625, 2627, 2657, 2700, 2718, 2811, 2961, 2962, 3045, 3046, 3283-3286, 3291-3293, 3332, 3352-3355, 3396, 3398, 3418, 3756, 3833, 4092, 4107, 4122, 4135, 4199, 4200, 4220, 4286, 4295, 4302, 4351, 4484, 4573, 4824, 4895, 4898, 4907, 4966, 4982, 4983, 4986.
Switzerland--200, 2182, 2821, 2822.
Syria--3718.

Taiwan--753, 1713, 1726, 1727, 2028, 2286, 2516, 3042, 3822, 3990, 4056, 4768, 5172.
Tasmania--3371.
Tennessee--758, 1265, 1476, 2614, 3220.
Terraces--40, 65, 530, 731, 1348, 1369, 1425, 1614, 1615, 1640, 1641, 1648, 1681, 1732, 1758, 1777, 1788b, 1806, 1838, 1935, 2009, 2013, 2044, 2060, 2061, 2089-2091, 2093, 2103, 2123, 2140, 2153, 2175, 2194, 2260, 2323, 2331, 2339, 2392, 2479, 2496, 2516, 2577, 2579, 2765, 2777, 2794, 2813, 2996-2999, 3004-3014, 3016, 3019, 3020, 3022, 3027, 3029, 3031, 3033-3035, 3037-3039, 3042-3044, 3048, 3049, 3051-3054, 3059-3063, 3067, 3073-3076, 3086-3090, 3094, 3096, 3104-3112, 3116, 3118-3125, 3127, 3128, 3133-3139, 3142, 3148, 3149, 3154, 3155, 3157, 3158, 3160, 3161, 3163, 3164-3171, 3174-3176, 3179, 3180, 3184-3190, 3192, 3199, 3218, 3219, 3222, 3228, 3231, 3233, 3236-3239, 3251, 3253, 3254, 3259, 3261-3263, 3265, 3267, 3270-3272, 3746, 3822, 3843, 3971, 4102, 4127, 4175, 4176, 4195, 4223, 4248, 4254, 4264, 4296, 4370, 4391, 4397, 4404, 4409, 4410, 4414, 4438, 4444, 4463, 4464, 4507, 4602, 4613, 4722, 4746, 4784, 4785, 5027, 5028, 5036.
Terracing machinery--1788b, 2090, 3011, 3013, 3048, 3109, 3115, 3148, 3157, 3166, 3188, 3236, 3258, 3261, 3268, 3269, 4102, 4127, 4175, 4176, 4195, 4223, 4248, 4254, 4264, 4296, 4370, 4391, 4404, 4409, 4410, 4414, 4438, 4444, 4463, 4464, 4722, 4746.
Texas--20, 1296, 1827, 1953, 2109, 2260, 2507, 2508, 2509-2511, 2519, 2554, 2573, 2623, 2766, 3015, 3096, 3106, 3107, 3156, 3233, 3360, 3510, 3636, 3673, 3725, 3835, 3839, 3886, 4030, 4066, 4112, 4499, 4561, 4615, 4628, 4945, 5050.
Theories and laws--392, 491, 601, 607, 652, 689, 737, 745, 831, 944, 968, 1056, 1059, 1243, 1268, 1280, 1325, 1329, 1340, 1378, 1407, 1437, 1455, 1456, 1517, 1531, 1539, 1560, 1563, 1584, 1587, 1626, 1639, 1642, 1656, 1716, 1718, 1720, 1746, 1754, 1760, 1762, 1763, 1767, 1778, 1792, 1811, 1822, 1840, 1850, 1852, 1863, 1865, 1866, 1873, 1875, 1876, 1885, 1897, 1968, 1972-1975, 1994, 2030, 2036, 2053, 2057, 2058, 2060, 2061, 2080, 2141, 2150, 2177, 2183, 2202, 2243, 2255, 2279, 2280, 2282, 2283, 2341, 2357, 2362, 2492, 3478, 3522, 3559, 3561, 3859, 3875.
Thailand--2445.
Tidal lands--1726, 1761, 2229, 2265, 2346, 2521, 3532, 3573, 3738, 4768.
Tile Drainage--45, 46, 112, 145-147, 199, 337, 338, 558, 769, 1004, 1052, 1293, 1312, 1617, 1650, 1654, 1655, 1656, 1658, 1662, 1663, 1665, 1666, 1669, 1671, 1677-1679, 1681, 1684, 1691, 1692, 1695, 1697, 1699, 1701, 1702, 1717, 1718, 1736, 1743, 1758, 1764, 1772, 1777, 1778, 1783, 1784, 1801, 1805, 1812, 1815, 1817, 1830, 1831, 1834, 1843-1846, 1848, 1852, 1854, 1857, 1865, 1866, 1872, 1881, 1882, 1894, 1897, 1900, 1901, 1906, 1907, 1913, 1922, 1924, 1925, 1945-1948, 1957, 1971, 1973, 1978, 1979, 1990, 1991, 2004, 2012, 2016, 2019-2021, 2035, 2047, 2051, 2053, 2054, 2057, 2058, 2068-2070, 2088, 2113, 2122, 2135, 2145, 2154, 2157-2159, 2163, 2191, 2213-2219, 2231, 2233,

Tile Drainage cont.--2237, 2246, 2249, 2253, 2258, 2266, 2276, 2278, 2292, 2297, 2298, 2307, 2331, 2338, 2340-2343, 2361, 2368, 2375, 2378, 2386, 2388, 2399, 2403, 2408, 2435, 2447, 2475, 2528, 2601, 2605, 2633, 2678, 2686, 2707, 2711, 2713, 2736, 2773, 2854, 2857, 2892, 2906, 2924, 2937, 2938, 2959, 2968, 3021, 3024, 3027, 3069, 3071, 3084, 3226, 3234, 3247, 3273, 3288-3291, 3295, 3299, 3302, 3306, 3308, 3310, 3311, 3316, 3317, 3319, 3322, 3323, 3331, 3340-3343, 3353, 3355-3358, 3367-3369, 3371, 3372, 3374-3376, 3378, 3381, 3384-3387, 3391, 3394-3396, 3399, 3400, 3403-3406, 3410, 3415-3417, 3420, 3422, 3425, 3426, 3429, 3431, 3434, 3436, 3438, 3444, 3451-3453, 3456, 3461-3464, 3471-3474, 3476-3478, 3480, 3485, 3488, 3490, 3492-3494, 3498, 3499, 3541, 3542, 3577, 3594, 3649, 3652, 3669, 3720, 3721, 3732, 3734, 3744, 3753, 3759, 3768, 3771, 3791, 3811, 3822, 3847, 3848, 3865, 3876, 3877, 3886, 3930, 3958, 3964, 3997, 4005, 4012, 4024, 4030, 4033, 4034, 4062, 4075, 4092, 4138, 4153, 4154, 4172, 4202, 4208, 4222, 4225, 4244, 4276, 4293, 4305, 4311, 4344, 4345, 4361, 4383, 4384, 4396, 4398, 4399, 4404, 4423, 4446, 4458, 4483, 4498, 4516, 4594-4596, 4759, 4774, 4777, 4840, 4842, 4848, 4931, 5029, 5031, 5035.

Tile junctions--1654-1656, 1945-1948, 2068, 2069, 2386, 3281.

Tillage--198, 328, 2253, 2479, 2546, 2548, 2590, 2600, 2608, 2705, 2895, 3276, 3465, 3470, 3609, 3632, 4021, 4944, 4957.

Tube drainage--2280, 2400, 2968, 3963, 4340, 4406, 4450, 4451.

Turkey--1170, 1606, 2001, 2278, 2325, 3663.

Unsaturated flow--491, 1346, 1510, 1665, 1798, 1818, 1819, 2128, 2173, 2180, 2231, 2282, 2357, 2358, 2369.

U.S.S.R.--37, 61, 78, 85, 113, 158, 159-161, 168, 177, 182, 194, 195, 208, 216, 217, 223, 224, 234-236, 238, 256, 257, 263, 265, 266, 284, 290, 293-295, 306, 307, 311, 312, 319, 320, 322, 339, 342, 344, 351, 364, 366, 371, 375, 376, 378, 381, 408, 419, 420, 435, 436, 465, 487, 493, 494, 551, 559, 560, 565, 566, 610, 613, 616, 675, 678, 687, 702, 724, 728, 733-735, 739, 742, 766, 767, 790, 816, 822, 832, 842-844, 847, 855, 858, 860, 865, 873, 875, 878, 881, 892, 940, 941, 946, 955, 957, 986, 987, 993-996, 1005, 1015, 1072, 1074, 1085, 1106, 1107, 1110, 1116, 1160, 1166, 1167-1169, 1179-1182, 1184, 1190, 1191, 1200, 1220, 1230, 1251, 1261, 1262, 1311, 1342, 1365, 1386, 1392, 1394, 1405, 1407, 1408, 1423, 1431, 1439, 1446, 1475, 1478, 1499, 1519, 1545, 1576, 1607, 1619, 1621, 1624, 1625, 1628, 1630, 1643, 1658, 1689, 1690, 1694, 1696, 1698, 1703, 1714, 1721, 1722, 1741, 1751, 1769, 1794, 1795, 1804, 1834, 1842, 1902, 1916-1921, 1927-1932, 1961-1964, 1981, 1992-1994, 1996, 1997, 2024, 2025, 2027, 2035, 2041, 2046, 2073, 2074, 2077, 2084, 2106, 2125, 2130, 2132, 2143, 2146-2148, 2160, 2165, 2166, 2174, 2186, 2199, 2200, 2227, 2230, 2232, 2234-2236, 2238, 2251, 2252, 2266, 2267, 2293, 2312, 2324, 2334, 2353, 2354, 2397, 2404-2407, 2411, 2412, 2416, 2418, 2431, 2433, 2436, 2437, 2439, 2441, 2454-2456, 2472, 2477, 2495, 2496, 2500, 2501, 2546, 2547, 2549, 2552, 2571, 2572, 2579, 2585, 2588, 2589, 2643, 2651, 2652, 2659, 2660, 2665, 2671-2673, 2682, 2683, 2692-2694, 2697, 2705-2707, 2709, 2714, 2735, 2741, 2743, 2744, 2746-2748, 2751, 2752, 2755, 2758, 2774, 2779, 2781, 2783, 2796, 2798, 2799, 2801, 2802, 2807, 2814, 2829-2834, 2836-2841, 2865, 2866, 2870-2873, 2877, 2882, 2883, 2886, 2894, 2912, 2914, 2925, 2926, 2929, 2934, 2945-2952, 2980, 2987, 2990-2993, 3019, 3023, 3043, 3062, 3063, 3073-3076, 3086, 3087, 3091, 3128, 3129, 3135, 3139, 3155, 3160, 3170, 3174, 3187, 3190, 3192, 3204-3206, 3219, 3223, 3224, 3230, 3253, 3267, 3268, 3274, 3275, 3277-3280, 3304, 3320, 3329, 3337, 3350, 3373, 3374, 3391, 3393, 3402, 3404, 3408, 3412, 3423, 3432, 3437, 3440, 3441, 3443, 3454-3457, 3460, 3469, 3482-3484, 3487, 3496-3500, 3506, 3513, 3517, 3518, 3535, 3538, 3539, 3550, 3553-3558, 3564, 3565, 3575, 3581-3584, 3589, 3590, 3596-3598, 3607-3612, 3615, 3617, 3620, 3624, 3630-3633, 3638, 3639, 3643-3645, 3651-3654, 3656, 3657, 3662, 3668, 3679, 3680, 3683, 3708, 3714-3717, 3724, 3726, 3727, 3740, 3748, 3775, 3776, 3785-3789, 3792-3796, 3800-3803, 3806, 3807, 3815-3818, 3820, 3823-3826, 3828, 3829, 3838, 3849-3851, 3853, 3857, 3866, 3869, 3870, 3878-3881, 3889, 3895, 3902-3905, 3912, 3913, 3917-3920, 3924-3926, 3931-3934, 3937, 3943-3945, 3950, 3962, 3972, 3974, 3982, 3989, 3992, 4014-4016, 4021, 4022, 4025, 4031, 4035-4041, 4045, 4046, 4050, 4051, 4053, 4078, 4082-4086, 4090, 4091, 4095, 4105, 4115-4118, 4132, 4156, 4161, 4174, 4184, 4185, 4195, 4197, 4198, 4202, 4228-4230, 4232, 4233, 4242, 4244, 4245, 4247, 4248, 4254, 4258-4262, 4265, 4267, 4269, 4276, 4277, 4296, 4300, 4301, 4303, 4306, 4308-4310, 4315, 4317, 4328, 4331, 4338, 4340, 4347, 4348, 4352, 4354, 4357-4359, 4364, 4372, 4389-4391, 4393-4395, 4397, 4400, 4402, 4403, 4412, 4426-4428, 4430-4432, 4434, 4435, 4460, 4461, 4466, 4468, 4471-4473, 4479, 4487, 4517, 4543, 4548, 4557, 4558, 4560, 4566, 4567, 4590, 4592, 4609, 4610, 4630, 4654, 4665, 4666, 4675, 4677, 4692, 4702, 4706-4708, 4723, 4736, 4741, 4742, 4751, 4763, 4766, 4767, 4770, 4780, 4785, 4786, 4789, 4820, 4822, 4823, 4825, 4827-4829, 4831, 4832, 4835, 4836, 4848, 4853, 4855, 4873, 4878, 4879, 4883-4887, 4899, 4903, 4910, 4911, 4913-4915, 4922, 4923, 4925, 4927, 4930, 4932, 4935,

U.S.S.R. cont.--4937, 4940, 4941, 4947, 4952-4960, 4962-4965, 4975, 4976, 4978, 4980, 4989, 4993, 4999, 5000, 5002, 5004-5007, 5009-5015, 5017, 5019, 5024, 5096, 5116, 5122, 5123, 5126, 5140-5142, 5145, 5158, 5165, 5181, 5185, 5186.
Utah--52, 126, 1055a, 1247, 1248, 1366, 1458, 1612, 1729, 1926, 2677, 2742, 2826, 2910, 2969, 3297, 3299, 3864, 4073, 4094, 4210, 4281, 4501, 4639, 4640, 4645, 5058, 5063, 5072, 5081, 5082, 5097.

Vegetable crops--284, 417, 458, 785, 931, 1882, 1936, 1985, 2088, 2264, 2397, 2449, 2459, 2494, 2565, 2567-2569, 2573, 2601, 2698, 2703, 2704, 2709, 2714, 2726-2729, 2731, 2743, 2798, 2851, 2870, 2935, 2996, 3188, 3788, 3806, 4407, 4408, 4832, 4945.
Vermont--1371, 1636, 1662, 1663, 3303, 3357.
Vertical drainage--1689, 1739, 1811, 2132, 2180, 2288, 2334, 3513, 3517, 3550, 3554, 3638, 3825, 4054, 4318.
Vertical mulching--593, 2283, 2478, 3287, 3360, 3390, 3470, 3674.
Viet Nam--5112.
Virginia--1122, 1233, 1409, 2355, 2567, 2731, 2732, 2890, 2931, 3059, 3255.

Washington--582, 928, 1196, 1222, 1380, 1897, 2494, 2778, 3311, 3485, 3755, 3763, 3764, 4055, 4534, 4777.
Water management--142, 243, 352, 779, 1300, 1428, 1616, 1750, 1775, 1825, 1899, 2482, 2559, 3587, 3698, 3728, 3760, 5053.
Water pollution--142, 1703, 1711, 1824, 1887, 1888, 2043, 2566, 2578, 2740, 2887, 2970.
Water quality--1706, 1710, 1757, 2430, 2441, 2484, 2487, 2507, 2523, 2529, 2535, 2536, 2566, 2573, 2578, 2596, 2598, 2611, 2649, 2685, 2699, 2715, 2740, 2763, 2815, 2828, 2881, 2887, 2893, 2963-2967, 2969, 2970, 3508, 3592, 3710, 3755, 3952, 4064, 4694, 5083.
Water rights--8, 28, 52, 54-60, 67, 70, 77, 118, 120, 132, 136, 1288, 1315.
Water yield--1189, 1190, 1195, 1218, 1219, 1221, 1222, 1226, 1227, 1229, 1233, 1246, 1272, 1274, 1289, 1292, 1293, 1305, 1310, 1312, 1314, 1318, 1324, 1327-1329, 1331, 1332, 1338, 1355, 1356, 1370, 1377, 1383, 1393, 1413, 1419-1421, 1423, 1432-1435, 1944, 1957-1959, 1961, 1962, 2035, 2155, 2156, 2181, 2242, 2250, 2415, 2685.
Waterfowl--2491, 5041, 5054, 5055, 5057, 5059, 5064, 5076, 5078, 5079, 5085, 5086, 5091, 5097.
Watershed Protection and Flood Prevention Act--13, 47, 94, 1228, 1242, 1303, 1380.
Watersheds--547, 772, 1192, 1193, 1196, 1197, 1199, 1206-1208, 1218, 1226, 1228, 1229, 1233, 1238, 1242, 1247, 1265, 1266, 1269, 1276, 1290-1294, 1297, 1299, 1303-1305, 1308, 1317, 1319, 1350, 1356, 1372, 1374, 1375, 1378, 1380, 1388, 1396, 1409, 1414-1417, 1426, 1432, 1434, 1437, 1438, 1440, 1442, 1445-1448, 1456, 1457, 1465, 1476, 1482, 1488, 1489, 1491, 1494-1496, 1649, 1724, 1832, 1833, 1915, 1944, 1958, 1959, 2819, 3116, 3533, 4168, 4362, 4478, 5056, 5065, 5184.
Waterways--65, 1641, 1725, 2327, 3022, 3132, 3193, 3239, 3262, 5087.
Weed and brush control--1635, 2270, 2271, 2494, 3689, 4090, 4113, 4137, 4191-4193, 4234, 4249, 4316, 4327, 4379-4381, 4385, 4478, 4480, 4481, 4486-4488, 4495, 4511, 4514, 4515, 4519, 4527, 4531, 4535, 4536, 4543, 4546, 4547, 4552, 4554, 4555, 4558, 4560, 4562, 4568, 4570, 4571, 4579, 4583-4586, 4593, 4609, 4610, 4612, 4618-4621, 4623, 4624, 4627-4629, 4646, 4655, 4662, 4669, 4673, 4680, 4683, 4685, 4692, 4693, 4696, 4702, 4706, 4713, 4721, 4724, 4726, 4735, 4737, 4740, 4749, 4750, 4761, 4762, 4773, 4775, 4790, 4793, 4794, 4796, 4801, 4813, 5061, 5071, 5089.
West Indies--157, 211, 672, 872, 2428.
West Virginia--1415-1417.
Western United States--44, 45, 77, 558, 827, 1202, 1203, 1221, 1222, 1445, 1458, 1461, 1481, 1493, 1799, 1800, 2463, 3324, 3649, 4492, 4775, 4761, 5038.
Wisconsin--963, 1063, 1243, 1276, 1435, 3030, 3110, 5054.
Wyoming--396, 1373, 1765, 1915, 4538, 4547, 4727, 4728, 4732.

Yugoslavia--807, 2044, 2818, 2998, 3118, 3154, 3254, 3465, 3549, 5117.